UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

July 13, 2004

TO: Files

FROM: D. Robert Lohn - Regional Administrator

SUBJECT: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Herd Creek 3 Diversion - HC 3, Herd Creek, 170602010506, Custer County, Idaho

Attached is a document containing a biological opinion (Opinion) prepared by NOAA's National Marine Fisheries Service (NOAA Fisheries) pursuant to section 7 of the Endangered Species Act (ESA) on the effects of the proposed Herd Creek 3 Diversion - HC 3, Herd Creek, 170602010506, Custer County, Idaho. NOAA Fisheries has provided funding for this project through the Pacific Coastal Salmon Recovery Fund. In this Opinion, NOAA Fisheries concludes that the proposed action is not likely to jeopardize the continued existence of ESA-listed Snake River spring/summer chinook salmon and Snake River steelhead, and not likely to destroy or adversely modify designated critical habitat. As required by section 7 of the ESA, NOAA Fisheries includes reasonable and prudent measures with nondiscretionary terms and conditions that NOAA Fisheries believes are necessary to minimize the impact of incidental take associated with this action.

This document contains a consultation on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and its implementing regulations (50 CFR Part 600). NOAA Fisheries concludes that the proposed action may adversely affect designated EFH for Snake River chinook salmon. As required by section 305(b)(4)(A) of the MSA, included are conservation recommendations that NOAA Fisheries believes will avoid, minimize, mitigate, or otherwise offset adverse effects on EFH resulting from the proposed action. As described in the enclosed consultation, 305(b)(4)(B) of the MSA requires that a Federal action agency must provide a detailed response in writing within 30 days of receiving an EFH conservation recommendation.

The lead biologists for this consultation are Jim Huinker at (208) 756-6483 or Larry Zuckerman at (208) 756-6496 of my staff in the East Idaho Branch Office.

Attachment

cc: A. Simpson - BOR
F. Auck - Shoshone-Bannock Tribes - without Enclosure
C. Coulter - Shoshone-Bannock Tribes
L. Denny - Shoshone-Bannock Tribes
H. Ray - Shoshone-Bannock Tribes
D. Johnson - Nez Perce Tribe - without Enclosure
I. Jones - Nez Perce Tribe
S. Althouse - Nez Perce Tribe
F. McGowan - Nez Perce Tribe
D. Mignogno - USFWS
T. Curet - IDFG
K. Bragg - CSWCD
T. Blau - IDWR

Endangered Species Act Section 7 Consultation Biological Opinion
and
Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation

Herd Creek 3 Diversion - HC 3
Snake River Spring/Summer Chinook Salmon and Snake River Basin Steelhead
Herd Creek
170602010506
Custer County, Idaho

Lead Action Agency: NOAA's National Marine Fisheries Service

Consultation Conducted By: NOAA's National Marine Fisheries Service, Northwest Region

Date Issued: 07-13-2004

Issued by: for Michael R Crouse

D. Robert Lohn
Regional Administrator

NMFS Tracking No.: 2004/00509

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1. INTRODUCTION

The Endangered Species Act (ESA) of 1973 (16 USC 1531-1544), as amended, establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with NOAA's National Marine Fisheries Service (NOAA Fisheries) and U.S. Fish and Wildlife Service (together "Services"), as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitats. This biological opinion (Opinion) is the product of a consultation pursuant to section 7(a)(2) of the ESA and implementing regulations
50 CFR 402.

The analysis also fulfills the Essential Fish Habitat (EFH) requirements under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan. Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (section 305(b)(2)).

The project proponents, the Shoshone-Bannock Tribes, propose to replace the existing push-up dam at the Herd Creek 3 diversion (HC 3 diversion) on Herd Creek, tributary to the East Fork Salmon River (EFSR) with a permanent structure. NOAA Fisheries has funded this project through the Pacific Coastal Salmon Recovery Fund (PCSRF). The purpose of the proposed diversion modification is to improve fish passage and habitat by reducing migration hazards, and eliminating the need for annual instream maintenance of the push-up dam. The action is proposed in a accordance with NOAA Fisheries' authority under the Pacific Salmon Treaty Act (Act) (Public Law 99-5, 16 U.S.C. 3634), as appropriated for carrying out the purposes and provisions of the Act for Pacific salmon recovery (Public Law 106-113, 16 U.S.C. 3641). The Act provides support to treaty Native American Tribes for salmon recovery and to meet the needs of the Pacific Salmon Commission and U.S. international commitments under the Act. The Shoshone-Bannock Tribes would be administering this project as the recipients of the PCSRF funding and are responsible for project implementation. The Bureau of Reclamation (BOR) has provided the project biological assessment (BA) and related documents for ESA and MSA consultation (per Reclamation Agreement No. 1425-03-MA-10-4170), technical support for project coordination, plan designs, and inspection during project implementation. The administrative record for this consultation is on file at the NOAA Fisheries Idaho State Habitat Office in Boise.

The PCSRF was established in FY2000 to provide grants to the states and treaty Native American Tribes to assist state, Tribal and local salmon conservation and recovery efforts. Under the FY2004 Consolidated Appropriations Act, a memorandum of understanding was added between NOAA Fisheries, the State of Idaho and affiliated treaty Native American Tribes as participants in the grant programming. The PCSRF supplements existing state, Tribal and Federal programs to further foster development of Federal-state-Tribal-local partnerships in salmon recovery and conservation. The PCSRF also promotes efficiencies and effectiveness in recovery efforts through enhanced sharing and pooling of capabilities, expertise and information. NOAA Fisheries is the Federal agency responsible for administration of the PCSRF in conjunction with the states and treaty Native American Tribes. The goal of the PCSRF is to make significant contributions to the conservation, restoration, and sustainability of Pacific salmon and their habitat. A majority of the PCSRF has been spent on habitat restoration activities, as this is where high priority needs exist for salmon recovery.

1.1 Background and Consultation History

NOAA Fisheries received a complete BA and EFH assessment on the Herd Creek 3 Water Diversion Project (HC 3 Project) on April 29, 2004, and consultation was initiated at that time. Meetings were held in the East Idaho Branch Office of NOAA Fisheries on November 3, 2003, February 4, and March 26, 2004, to discuss the HC 3 Project. Attending in person or via conference call were representatives of the BOR, NOAA Fisheries, Fish and Wildlife Service (FWS), and the Shoshone-Bannock Tribes. The meeting agendas included administrative items (e.g. PCSRF funding, consultation procedures, and BA comments), and technical review topics (e.g. engineering designs, plans, and work windows). Design changes to project-related activities were agreed to by the engineers representing the BOR and NOAA Fisheries, and were adopted by consensus. The water diversion structure (as modified) will facilitate safe fish passage by increasing flows and depths within the natural channel and through the proposed permanent weir structure during low water periods, while maintaining flows through an ephemeral side channel at high water. The participants also agreed to monitoring in the action area and work window modifications. The Shoshone-Bannock Tribes will submit final contract documents to NOAA Fisheries in July 2004. The final contract documents will have all conservation measures and conditions of this consultation incorporated.

The HC 3 Project would likely affect tribal trust resources. Because the action is likely to affect tribal trust resources, NOAA Fisheries has contacted the Shoshone-Bannock Tribes and the Nez Perce Tribe pursuant to the Secretarial Order (June 5, 1997). The Shoshone-Bannock Tribes, as the project proponents, expressed significant interest in this consultation; and a tribal representative participated in the consultation meetings on November 3, 2003, February 4 and March 26, 2004. The Shoshone-Bannock Tribes finalized the draft BA and sent it to NOAA Fisheries with a cover letter to initiate formal consultation. The draft Opinion was sent on June 15, 2004, to the Shoshone-Bannock Tribes, the Nez Perce Tribe and the BOR for their review and comments prior to issuance of the final Opinion. No comments were received from the Shoshone-Bannock Tribes on the draft Opinion. An email response by the Nez Perce Tribe was received on June 16, 2004, and clarifications were made to the work window conditions. On

June 21, 2004, NOAA Fisheries contacted the BOR regarding comments to the draft Opinion, to which clarifications were made to the terms and conditions, specifically to onsite monitoring and instream work.

1.2 Proposed Action

Proposed actions are defined in the Services' consultation regulations (50 CFR 402.02) as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." Additionally, U.S. Code (16 U.S.C. 1855(b)(2)) further defines a Federal action as "any action authorized, funded, or undertaken or proposed to be authorized, funded, or undertaken by a Federal agency." Because NOAA Fisheries proposes to fund the action that may affect listed resources, it must consult under ESA section 7(a)(2) and MSA section 305(b)(2).

The purpose of the proposed action is to improve passage for freshwater life stages of anadromous and resident fish species. To accomplish this, the HC 3 Project will replace the existing push-up gravel dam with a permanent rock weir that also spans Herd Creek. The existing gravel dam impedes anadromous fish passage, and requires regular instream mechanized maintenance and repairs. The new weir and point of diversion will be approximately 30 feet downstream of the existing diversion. The relocated weir will protect juvenile salmonid rearing habitat that is provided by a natural overflow channel, which flows through the low point of a depositional bar just upstream of the existing diversion. Instream work is to take no more than two weeks and will be conducted within a work window of June 15 to July 31 that is designed to protect vulnerable egg and alevin life stages of Snake River spring/summer chinook salmon. No active Snake River Basin steelhead redds were observed in the action area (SBT 2004).

A new weir will be constructed using 3-4 foot diameter rock. Work will begin midstream, and the rock will be carefully placed in a linear fashion across the stream channel, one side of the weir structure at a time. The rock weir wings will form the shape of an inverted "V". The apex of the inverted "V" will point upstream. The weir will be designed at a 6.4 percent adverse slope toward the streambanks. The wings will be keyed into the streambanks. To enable fish passage during low flows, the rock weir will be configured to have a 12 inch deep, 9-foot wide notch near mid-channel. A steel plate will be installed across the bottom crest of the low flow notch to maintain adequate grade control for fish passage.

An impervious and flexible geotextile membrane will be installed in the upstream face of the weir to eliminate water infiltration through the diversion structure. The membrane will be armored with rock to hold it in place and add integrity to the structure. The membrane will extend 10 feet upstream of the weir to reduce seepage under the structure, bringing water to the surface and through the fish notch and improving fish passage conditions under low flows.

A metal headgate and ramp flume will be installed to regulate and limit flows into the diversion ditch, resulting in improved stream channel flows and fish passage through the action area in comparison to the operation of the existing facilities. The headgate will be located on the right bank (downstream), adjacent to the new weir, and will include a trash rack and wasteway channel for sluicing excess flow, debris, and sediment back into the main channel. The existing headgate allows unregulated flow into the conveyance system and could conceivably dewater the entire reach during low-flow periods. Instream work will be accomplished in the wet (i.e. without coffer dams) using a backhoe or excavator, and fish passage through the action area will be maintained at all times during instream activities.

Approximately 100 feet upstream of the new diversion structure, at the inlet of the seasonal overflow channel, the streambed will be armored to reduce the risk that the stream may change course as a result of high flows and bypass the new weir structure. For a length of approximately 25 feet, large rock will be partially buried in the streambed across the channel inlet to prevent obstruction of flows or fish passage.

To provide equipment access to the work area during the construction phase, 1000 linear feet of the diversion ditch will be temporarily filled. A local upland site will be the source of the clean fill. Upon completion, the fill will be removed and hauled to an upland site. The ditch channel and embankments will be reshaped and configured to sufficiently accept diversion flows, while minimizing risk of contributing sediments into Herd Creek or other waters**.** Disturbed areas will be sown with native seed appropriate to the site. The existing irrigation ditch will be excavated approximately one foot (on average) below the previous elevation (a distance of 150 feet) to connect into the new headgate and diversion structure. This will provide adequate head pressure to operate the gravity flow irrigation system with the new point of diversion.

The designated staging area for construction equipment will be approximately 50 yards downstream of the new headgate, along the right bank of Herd Creek in a meadow area. Equipment staging will be at least 100 feet from Herd Creek, will include spill containment equipment as described in the BA, and these requirements will be included in the final contract documents.

<u>Conservation measures that were identified in the BA include:</u>

1. Project implementation will occur in compliance with Idaho Department of Environmental Quality (IDEQ) best management practices (BMPs).

2. All construction will follow BMPs and the HC 3 Project design criteria, and will be inspected by the Shoshone-Bannock Tribes, BOR engineers and a contract inspector during the construction period. The construction and inspection requirements will be included in the final contract documents

3. All fuel, petroleum products, and chemicals will be stored in full containment cells at least 100 feet from any stream, wetland, or waterbody, if they are stored or used onsite. Fueling will occur at least 100 feet from any stream or waterbody.

4. Emergency spill containment equipment will be available at all times to manage any petroleum product releases that may occur. Any spill or leak will be cleaned up immediately. Emergency notification, and reporting guidelines (required by IDEQ, Occupational Safety and Health Administration, and the Environmental Protection Agency) will be followed. NOAA Fisheries and the FWS will also receive reports, data, and other relevant documents for spills reported to the above agencies.

5. All staging areas for equipment and vehicles left onsite will be at least 100 feet away from any waterbody and use drip pans as needed to prevent soil and water contamination from leaks or spills.

6. All equipment used for instream work will be inspected each day and whenever fueling takes place to ensure there are no releases of fuel, oil, hydraulic fluid or other pollutant releases from the equipment. All leaks found will be fixed prior to the equipment entering the channel to work. Equipment will be steam cleaned prior to entering the stream channel or riparian area.

7. No chemical dust palliatives will be used within 25 feet of any waterbody. Water will be the preferred agent for dust suppression. Only a water withdrawal site (in the action area) approved by a consensus between NOAA Fisheries and the Shoshone-Bannock Tribes will be used. Water drafting will utilize 3/32 inch screens on the intake hose and will meet NOAA Fisheries screening criteria (NMFS 1995; and NMFS 1996a).

8. Areas disturbed by construction activities will be replanted and/or reseeded by project completion, if sufficient growing time allows, or by the beginning of the next growing season. Site reclamation will include utilizing native plant materials suitable to the site.

9. If changes develop in the project plan, NOAA Fisheries and FWS will be notified and consultation reinitiated as described below (section 2.4).

Instream work will not extend more than 14 days, within a work window from June 15 to July 31. The Shoshone-Bannock Tribes will periodically perform snorkeling surveys in Herd Creek to determine emergence and sufficient development of fry for safe emigration from the action area prior to implementation of instream activities. Work will be conducted in the wet, but fish passage will be maintained at all times. A water pump with 3/32 inch screens on the intake hose (NMFS 1996a) will be used to siphon the turbid water from the immediate work area into the adjoining wetland to allow wetland substrate development and infiltration back into the watertable and stream channel. Daily stream surveys will monitor fish and/or redd absence or presence in the action area prior to implementation of instream activities. Work will cease and NOAA Fisheries will be notified when a fish and/or redd is found in the action area. Work will not resume until discussions with NOAA Fisheries and the Shoshone-Bannock Tribes determine that it is safe to do so, or if an alternative work window is warranted.

The water withdrawal itself is not considered an interrelated/interdependent activity of the proposed action, because it has occurred and would continue to occur in the absence of the proposed action. The effects of the HC 3 diversion water withdrawal on reducing instream flows are therefore not analyzed, and the withdrawal itself is not ESA-authorized through this Opinion.

1.3 Description of the Action Area

An action area is defined by the Services' regulations (50 CFR Part 402) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The action area starts at about 100 yards upstream of River Mile 3, and extends downstream past the existing HC 3 diversion on Herd Creek, tributary of the EFSR, in T.9N., R.18E., Section 18, Custer County, Idaho, to about 0.5 mile downstream of River Mile 3. The sixth field hydrologic unit code (HUC) encompassing the action area is 170602010506. This area serves as a migratory corridor and provides spawning and rearing habitat for Snake River spring/summer chinook salmon (*Oncorhynchus tshawytscha*) and Snake River Basin steelhead (*O. mykiss*). It is within the salmonid Evolutionarily Significant Units (ESUs) listed in Table 1 (Reeves *et al.*, 1995), and includes EFH for chinook salmon.

This stream reach is occupied by freshwater life stages of Snake River spring/summer chinook salmon and Snake River Basin steelhead, and is designated critical habitat for Snake River spring/summer chinook salmon. Snake River sockeye salmon (*O. nerka*) do not occur in Herd Creek, nor elsewhere in the EFSR watershed.

2. ENDANGERED SPECIES ACT - BIOLOGICAL OPINION

The objective of this Opinion is to determine whether the HC 3 Project is likely to jeopardize the continued existence of Snake River spring/summer chinook salmon and Snake River Basin steelhead, or destroy or adversely modify designated critical habitat.

2.1 Evaluating the Effects of the Proposed Action

The standards for determining jeopardy and destruction or adverse modification of critical habitat are set forth in section 7(a)(2) of the ESA. In conducting analyses of habitat-altering actions under section

7 of the ESA, NOAA Fisheries uses the following steps of the consultation regulations and when appropriate[1] combines them with The Habitat Approach (NMFS 1999):
(1) Consider the biological requirements and status of the listed species; (2) evaluate the relevance of the environmental baseline in the action area to the species' current status;
(3) determine the effects of the proposed or continuing action on the species, and whether the action is consistent with any available recovery strategy; and (4) determine whether the species can be expected to survive with an adequate potential for recovery under the effects of the proposed or continuing action, the effects of the environmental baseline, and any cumulative effects, and considering measures for survival and recovery specific to other life stages. In completing this step of the analysis, NOAA Fisheries determines whether the action under consultation, together with all cumulative effects when added to the environmental baseline, is likely to jeopardize the ESA-listed species or result in the destruction or adverse modification of critical habitat. If jeopardy or adverse modification are found, NOAA Fisheries may identify reasonable and prudent alternatives for the action that avoid jeopardy and/or destruction or adverse modification of critical habitat.

The fourth step above (jeopardy/adverse modification analysis) requires a two-part analysis. The first part focuses on the action area and defines the proposed action's effects in terms of the species' biological requirements in that area (i.e., effects on essential habitat features). The second part focuses on the species itself. It describes the action's effects on individual fish, populations, or both, and places that impact in the context of the ESU as a whole. Ultimately, the analysis seeks to determine whether the proposed action is likely to jeopardize a listed species' continued existence or destroy or adversely modify its critical habitat.

2.1.1 Biological Requirements

The first step NOAA Fisheries uses when applying ESA section 7(a)(2) to the listed ESUs considered in this Opinion includes defining the species' biological requirements within the action area. Biological requirements include population characteristics necessary for the listed ESUs to survive and recover to naturally reproducing population sizes at which protection under the ESA would become unnecessary. The listed species' biological requirements may be described as characteristics of the habitat, population or both (McElhany *et al.* 2000).

NOAA has identified population size biological requirements through interim recovery targets. The target for Snake River Basin steelhead in the Upper Salmon River subbasin is 4,700 adult spawners, while the target for spawning adult Snake River spring/summer chinook salmon is 5,100 fish (NMFS 2002).

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[1] The Habitat Approach is intended to provide guidance to NOAA Fisheries staff for conducting analyses, and to explain the analytical process to interested readers. As appropriate, the Habitat Approach may be integrated into the body of Opinions.

For actions that affect freshwater habitat, NOAA Fisheries may describe the habitat portion of a species' biological requirements in terms of a concept called properly functioning condition (PFC). The PFC is defined as the sustained presence of natural[2] habitat-forming processes in a watershed that are necessary for the long-term survival of the species through the full range of environmental variation (NMFS 1999). The PFC, then, constitutes the habitat component of a species' biological requirements. Although NOAA Fisheries is not required to use a particular procedure to describe biological requirements, it typically considers the status of habitat variables in a matrix of pathways and indicators (MPI) (NMFS 1996b) that were developed to describe PFC in forested montane watersheds. In the PFC framework, baseline environmental conditions are described as "properly functioning", "at risk," or "not properly functioning".

The HC 3 Project would occur within designated critical habitat for the Snake River spring/summer chinook salmon. Essential features of critical habitat include: (1) Substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food (juvenile only), (8) riparian vegetation, (9) space, and (10) safe passage conditions. For this consultation, the essential features that the action may affect and that function to support successful adult and juvenile migration, adult holding, spawning, incubation, rearing, and growth and development to smoltification include: substrate, water quality, water quantity, water temperature, water velocity, and safe passage conditions. All of these essential features of critical habitat are included in the MPI (NMFS 1996b) (discussed in more detail in this Opinion in Section 2.2.1 and Appendix C).

2.1.2 Status and Generalized Life History of Listed Species

In this step, NOAA Fisheries also considers the current status of the listed species within the action area, taking into account population size, trends, distribution, and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list the species and also considers any new data that are relevant to the species' status. Please refer to Appendix A (online at website Appendix A: *http://www.nwr.noaa.gov/1habcon/habweb/habguide/habpub.htm*) for discussions of the general life histories of the listed species.

[2] The word "natural" in this definition is not intended to imply "pristine," nor does the best available science lead us to believe that only pristine wilderness will support salmon.

Table 1. References for additional background on listing status, critical habitat designation, protective regulations, and life history for the ESA-listed and candidate species considered in this consultation.

Species ESU	Status	Critical Habitat Designation	Protective Regulations	Life History
Chinook salmon (*Oncorhynchus tshawytscha***)**				
Snake River spring/summer	Threatened; April 22, 1992; 57 FR 14653[2]	October 25, 1999, 64 FR 57399[3]	July 10, 2000; 65 FR 42422	Matthews and Waples 1991; Healey 1991
Steelhead (*O. mykiss* **)**				
Snake River Basin	Threatened; August 18, 1997; 62 FR 43937	not designated[4]	July 10, 2000; 65 FR 42422	Busby *et al*. 1996; Fish Passage Center 2001a&b; BRT 1998

2.1.2.1 Snake River Spring/Summer Chinook Salmon

The Snake River spring/summer chinook salmon ESU, listed as threatened on April 22, 1992 (67 FR 14653), includes all natural-origin populations in the Tucannon, Grande Ronde, Imnaha, and Salmon Rivers. Some or all of the fish returning to several of the hatchery programs are also listed, including those returning to the Tucannon River, Imnaha, and Grande Ronde hatcheries, and to the Sawtooth, Pahsimeroi, and McCall hatcheries on the Salmon River. Critical habitat was designated for Snake River spring/summer chinook salmon on December 28, 1993 (58 FR 68543) and was revised on October 25, 1999 (64 FR 57399).

The Snake River drainage is thought to have produced more than 1.5 million adult spring/summer chinook salmon in some years during the late 1800s (Matthews and Waples 1991). By the 1950s the abundance of spring/summer chinook had declined to an annual average of 125,000 adults and by the

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[3] This corrects the original designation of December 28, 1993, 58 FR 68543 by excluding areas above Napias Creek Falls, a naturally impassable barrier.

[4] Critical habitat for Snake River Basin steelhead trout was administratively withdrawn on April 30, 2002, and is not designated at this time.

mid-1960s, further declines to an average of about 60,000 adults. Adult returns counted at Lower Granite Dam reached all-time lows in the mid-1990s, and numbers have begun to increase since 1997. Over a 10-year period from 1992 to 2001, which includes the year of listing (1992), returns of wild/natural fish ranged from 183 in 1994 to 12,475 in 2001, and averaged 3,314 salmon adults. The estimated smolt production capacity of 10 million smolts for rivers in Idaho, coupled with historic smolt to adult return rates of two percent to six percent, indicate Idaho could produce wild/natural runs of 200,000 to 600,000 adults (Fish Passage Center 2002 and 2003). The recent low numbers are reflected throughout the entire distribution of chinook salmon subpopulations scattered throughout the Grande Ronde, Imnaha, Tucannon, and Salmon River Basins. Redd counts and estimates of parr and smolt densities generally indicate that fish production is well-below the potential, and continuing to decline.

Although there were record returns in 2000 and 2001, ESU numbers are in general very low in comparison to historic levels (Beven *et al.* 1994). Average returns of adult Snake River spring/summer chinook salmon (averaging 3,314 over a recent 10-year period) are also low in comparison to interim target species recovery levels of 44,766 for the Snake River Basin (NMFS 2002). The low returns amplify the importance that a high level of protection be afforded to each adult chinook salmon, particularly because a very small percentage of salmon survive to the life stage of a returning, spawning adult, and because these fish are in the final stage of realizing their reproductive potential (approximately 2,000 to 4,000 progeny per adult female).

Habitat impairment is common in the range of this ESU. Spawning and rearing habitats are likely impaired by factors such as tilling, water withdrawals, timber harvest, grazing, mining, and alteration of floodplains and riparian vegetation. Mainstem Columbia River and Snake River hydroelectric developments have altered flow regimes and estuarine habitat, and disrupted migration corridors. Competition between natural indigenous stocks of spring/summer chinook salmon and spring/summer chinook of hatchery origin has likely increased due to an increasing proportion of naturally-reproducing fish of hatchery origin.

Compared to the greatly reduced numbers of returning adults for the last several decades, exceptionally large numbers of adult chinook salmon returned to the Snake River drainage in 2000 and in 2001. These large returns are thought to be a result of favorable ocean conditions, and above average flows in the Columbia River Basin (CRB) when the smolts migrated downstream. These large returns are only a fraction of the estimated returns of the late 1800s. Recent increases in the population are not expected to continue, and the long-term trend for this species indicates a decline. Detailed information on the range-wide status of Snake River chinook salmon under the environmental baseline, is described in chinook salmon status reviews (Myers *et al*. 1998 and BRT 2003). Habitat improvements would not necessarily correspond to increased salmon productivity because a myriad of other factors can still depress populations, but diminished quality would probably correspond to reduced productivity (Regetz 2003). Additional information on the biology, status, and habitat elements for Snake River spring/summer chinook salmon is described in Appendix A and the status review updates (BRT 1998, 2003).

Recent chinook redd count data (IDFG 2004) for the Herd Creek sub-watershed indicate an increase in Snake River spring/summer chinook salmon spawning. The Shoshone-Bannock Tribes' fall 2003 Snake River spring/summer chinook salmon redd count was 74 redds for the Herd Creek sub-watershed. The Shoshone-Bannock Tribes' 2003 survey data (SBT 2004) show approximately two chinook salmon redds within one mile upstream of the existing HC 3 diversion. Four chinook salmon redds are in close proximity upstream and seven are in close proximity downstream of the HC 3 diversion. There are 14 other chinook salmon redds further downstream of the HC 3 diversion and upstream of HC 2. Of the 11 total chinook redds in close proximity, four redds were surveyed within the immediate vicinity of the HC 3 diversion (Ray, pers. com. 2004) and confirmed from an April 1, 2004 site visit. Herd Creek is producing chinook salmon at a level much lower than its natural potential. At least four miles of adequate spawning habitat in the Herd Creek sub-watershed (about 36% of the total chinook salmon spawning habitat in the East Fork watershed) should be capable of producing 260,000 smolts per year (based on an assumption of 200 adult fish per mile and an egg-to-smolt survival rate of 15%) (ISCC 1995).

2.1.2.2 Snake River Basin Steelhead

The Snake River Basin steelhead ESU, listed as threatened on August 18, 1997 (62 FR 43937), includes all natural-origin populations of steelhead in the Snake River Basin of Southeast Washington, northeast Oregon, and Idaho. One of the hatchery stocks in the Snake River Basin is listed (originating from Dvorshak Reservoir) under the B-Run Program (Pollard, pers. com. 2004), and several are included in the ESU. Critical habitat for Snake River Basin steelhead was administratively withdrawn on April 30, 2002, and is not designated at this time.

Natural runs of Snake River Basin steelhead have been declining in abundance over the past decades. Some of the significant factors in the declining populations are mortality associated with the many dams along the Columbia and Snake Rivers, losses from harvest, loss of access to more than 50 percent of their historic range, and degradation of habitats used for spawning and rearing. Possible genetic introgression from hatchery stocks is another threat to Snake River Basin steelhead since wild fish comprise such a small proportion of the population. Additional information on the biology, status, and habitat elements for Snake River Basin steelhead is described in Busby *et al*. (1996) and Appendix A.

The 2000 and 2001 counts at Lower Granite Dam indicate a short-term increase in returning adult spawners. Adult returns (hatchery and wild) in 2001 were the highest in 25 years, and 2000 counts were the sixth highest on record (Fish Passage Center 2001a). Increased levels of adult returns are likely a result of favorable ocean and instream flow conditions for these cohorts. _Although steelhead numbers have dramatically increased, wild steelhead comprise only 10-20 percent of the total returns since 1994. Recent increases in the population are not expected to continue, and the long-term trend for this species indicates a decline.

Survival of downstream migrants in 2001 was the lowest level since 1993. Low survival was due to record low run-off volume and elimination of spills from the Snake River dams to meet hydropower demands (Fish Passage Center 2001b). Average downstream travel times for steelhead nearly doubled and were among the highest observed since recording began in 1996. Consequently, wide fluctuations in population numbers are expected over the next few years when adults from recent cohorts return to spawning areas. Detailed information on the current range-wide status of Snake River Basin steelhead, under the environmental baseline, is described in the steelhead status review (Busby *et al*. 1996), and the status review update (BRT 2003). Please see Appendix A of this Opinion for more information.

On Herd Creek, one Snake River Basin steelhead redd was found during the spring 2003 survey (approximately three quarters mile downstream of the HC 3 diversion), with the spring 2004 redd count still pending (Ray, pers. com. 2004).

2.1.3 Environmental Baseline in the Action Area

The environmental baseline is defined as: "the past and present impacts of all Federal, state, or private actions and other human activities in the action area, including the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation and the impacts of state and private actions that are contemporaneous with the consultation in progress" (50 CFR 402.02). In step 2, NOAA Fisheries' evaluates the relevance of the environmental baseline in the action area to the species' current status.

In general, the environment for listed species in the CRB, including those that migrate past or spawn upstream from the action area, has been dramatically affected by the development and operation of the Federal Columbia River Power System (FCRPS). Storage dams have eliminated mainstem spawning and rearing habitat, and have altered the natural flow regime of the Snake and Columbia Rivers, decreasing spring and summer flows, increasing fall and winter flow, and altering natural thermal patterns. Power operations cause fluctuation in flow levels and river elevations, affecting fish movement through reservoirs, disturbing riparian areas and possibly stranding fish in shallow areas as flows recede. The eight dams in the migration corridor of the Snake and Columbia Rivers kill or injure a portion of the smolts passing through the area. The low velocity movement of water through the reservoirs behind the dams slows the smolts' journey to the ocean and enhances the survival of predatory fish (Independent Scientific Group 1996, National Research Council 1996). Formerly complex mainstem habitats in the Columbia, Snake, and Willamette Rivers have been reduced, for the most part, to single channels, with floodplains reduced in size, and off-channel habitats eliminated or disconnected from the main channel (Sedell and Froggatt 1984; Independent Scientific Group 1996; and Coutant 1999). The amount of large woody debris in these rivers has declined, reducing habitat complexity and altering the rivers' food webs (Maser and Sedell 1994).

Other human activities that have degraded aquatic habitats or affected native fish populations in the CRB include stream channelization, elimination of wetlands, construction of flood control dams and levees, construction of roads (many with impassable culverts), timber harvest, splash dams, mining, water withdrawals, unscreened water diversions, agriculture, livestock grazing, urbanization, outdoor recreation, fire exclusion/suppression, artificial fish propagation, fish harvest, and introduction of non-native species (Henjum *et al.* 1994; Rhodes *et al.* 1994; National Research Council 1996; Spence *et al.* 1996; and Lee *et al.* 1997). In many watersheds, land management and development activities have: (1) reduced connectivity (i.e., the flow of energy, organisms, and materials) between streams, riparian areas, floodplains, and uplands; (2) elevated fine sediment yields, degrading spawning and rearing habitat; (3) reduced large woody material that traps sediment, stabilizes streambanks, and helps form pools; (4) reduced vegetative canopy that minimizes solar heating of streams; (5) caused streams to become straighter, wider, and shallower, thereby reducing rearing habitat and increasing water temperature fluctuations;
(6) altered peak flow volume and timing, leading to channel changes and potentially altering fish migration behavior; and (7) altered floodplain function, water tables and base flows (Henjum *et al.* 1994; McIntosh *et al.* 1994; Rhodes *et al.* 1994; Wissmar *et al.* 1994; National Research Council 1996; Spence *et al.* 1996; and Lee *et al.* 1997).

To address problems inhibiting salmonid recovery in CRB tributaries, the Federal resource and land management agencies developed the *All H Strategy* (Federal Caucus 2000). Components of the *All H Strategy* commit these agencies to increased coordination and a fast start on protecting and restoring.

Pacific salmon populations also are substantially affected by variation in the freshwater and marine environments. Ocean conditions are a key factor in the productivity of Pacific salmon populations. Stochastic events in freshwater (flooding, drought, snowpack conditions, volcanic eruptions, etc.) can play an important role in a species' survival and recovery, but those effects tend to be localized compared to the effects associated with the ocean. The survival and recovery of these species depends on their ability to persist through periods of low natural survival due to ocean conditions, climatic conditions, and other conditions outside the action area. Freshwater survival is particularly important during these periods because enough smolts must be produced so that a sufficient number of adults can survive to complete their oceanic migration, return to spawn, and perpetuate the species. Therefore it is important to maintain or restore essential features and PFC in order to sustain the ESU through these periods. Additional details about the importance of freshwater survival to Pacific salmon populations can be found in Federal Caucus (2000), NMFS (2000), and Oregon Progress Board (2000).

The Herd Creek sub-watershed (74,496 acres) drains northwest into the EFSR (IDEQ 2003), between the Sawtooth Mountain range and the White Cloud Peaks range (Emmett 1975). Herd Creek is 8.5 miles long from the mouth upstream to the National Forest Boundary (Trapani 2002). The 96 miles of perennial streams in the sub-watershed include major tributaries to Herd Creek such as Lake Creek, East Pass Creek, East and West Fork Herd Creek, and Middle Canyon Creek. Elevations range from 10,000 feet in the Sawtooth Mountains to 5,700 feet at the confluence with the EFSR, having an average gradient of 4.2 percent (USDA-FS 1997). The majority (91%) of the perennial streams are source-type channels (Rosgen A) with gradients greater than four percent (Rosgen 1996). The remaining stream channels are six percent transport-type (Rosgen B) and three percent response-type (Rosgen C). Herd Lake (20 acres) is located on upper Lake Creek at the end of the only major road in the sub-watershed, and is a popular camping and fishing area (IDEQ 2003).

Average annual precipitation in the EFSR watershed is 10 to 15 inches. Precipitation averages are near 10 inches in proximity of the mouth of Herd Creek, while headwater reaches experience approximately 20 to 25 inches (USDI-BLM 1998). Approximately 70% of the precipitation falls during the spring and fall seasons (IDEQ 1999). The wettest months occur in April, May and June, with January through March experiencing the driest conditions (USDI-BLM 1998). Severe winters with six or more feet of snow accumulating at the higher elevations are possible, while snow fall near the mouth is less, but more variable (USDI-BLM 1999). The majority of the sub-watershed land base is managed by the Salmon-Challis National Forest (72%), with some of the tributary headwaters draining a proposed wilderness area. Twenty four percent of the lowest four to five miles of Herd Creek is managed by the Bureau of Land Management (BLM), some of which is within a wilderness study area. Three percent is state-owned land and one percent is under private ownership (IDEQ 2003).

Human activities since the mid-1800s are likely to have changed the hydrology within the greater EFSR watershed as a result of beaver trapping and dam removal, stream channel alterations, riprapping of banks, riparian vegetation removal, and diversion of flows for irrigation and livestock watering. Limiting stream flow access to the floodplain has changed the hydrography of the river system from one that slowly releases up-gradient stored water to one that releases water within a shortened time frame ("flashy"). The results of these modifications are reflected in a degraded aquatic habitat for ESA-listed anadromous salmonids with lower late summer flows and higher water temperatures (USDI-BLM 1998). Altered habitat elements such as substrate, safe passage conditions, and water quality result from degraded conditions caused by such human activities over time.

Water temperatures measured at several locations in Herd Creek and Lake Creek from 1993 to 1996 show that maximum temperatures in this time frame rarely exceeded 22°C, and often exceeded 13°C during the summer months (USDA-FS 1997). The maximum water temperature at lower Herd Creek during the sampling period was 22.4°C in 1994 and 15.5°C in 1995. Other maximum temperatures at the same site were moderate at 16.4° C and 16.5° C for 1993 and 1996, respectively. In 2001, the maximum seven day average of daily maximum temperature in upper Herd Creek and East Pass Creek was 14.4°C. Herd Creek is not included in the 1998 303(d) list of impaired stream segments for the Upper Salmon River subbasin (IDEQ 2003). There are functional beaver dams in Herd Creek, upstream of the action area that may provide some settling of sediments. There may also be upstream juvenile chinook salmon rearing habitat above the dams (Ray, pers. com. 2004).

Riparian communities in the sub-watershed historically included Geyer willow, booth willow, cottonwood, water birch and alder as the woody species component. Various species of rushes and sedges dominated hydric herbaceous communities (IDEQ 2003). Approximately two percent of the sub-watershed vegetation cover type consists of riparian communities, found within riverine and lacustrine land features, and associated with seeps, bogs, springs, wet meadows, and ponds. Hydric plant communities occupy the principle drainages (Herd Creek, Lake Creek, East and West Fork Herd Creek and East Pass Creek), scattered along intermittent and ephemeral streams (Spring Gulch and Monumental Gulch) and other unnamed tributaries (USDI-BLM 2002). The community plant structure within the riparian zone varies based on the frequency of flooding, amount of scouring, and the intensity of human disturbance (past and present). Riparian communities have been altered by agriculture and other land uses and reflect current degraded riparian vegetation conditions, especially on private property.

Some of the riparian lands along Herd Creek and its tributaries are dedicated to livestock grazing, forage production, and include water diversion and conveyance systems. There are 246 acres of irrigated agricultural lands in the Herd Creek sub-watershed (USDA-FS 1997). The Forest Service has 26 consumptive use claims for stock water. On BLM managed lands, there are 247 water right claims on springs, and five claims are recorded for stock water. The Idaho Department of Fish and Game (IDFG) has two water right claims for bypass flows at fish screens, and the Idaho State Department of Lands has one claim for irrigation (USDA-FS 1997).

Gold mining in the 1860s occurred in the EFSR watershed, with the Livingston Mine on Big Boulder Creek the most notable. A dam built on the creek for power generation for mine operations blocked fish migration for many decades and was finally removed in 1991. Sedimentation and heavy metal contamination of Big Boulder Creek, East Fork and the mainstem Salmon River resulted from more than 50 years of gold mining. Recently, the Shoshone-Bannock Tribes performed various habitat improvement projects in the watershed to repair damage from human activities, such as mining. Such improvements include riparian restoration work on Herd Creek, specifically in the vicinity of the HC 3 diversion and downstream.

Historically, Herd Creek produced significant numbers of chinook salmon as one of the main salmonid producers in the EFSR watershed (Trapani 2002). IDFG began chinook spawning surveys in 1958. Herd Creek has produced approximately 283 redds (in 1961), and 202 redds in 1963 (IDFG 2004). On average, Herd Creek has produced approximately 44 chinook redds per year from 1958 to 2003. In 2002, there were 22 redds in Herd Creek that produced an estimated 13,200 chinook salmon parr (Ray *et al*. 2004). This was the second highest production of chinook salmon parr since 1998. Recent Snake River spring/summer chinook redd count data in Herd Creek reveal an upward trend in returning fish numbers and fecundities from 22 redds in 2001, 59 redds in 2002, and 74 redds in 2003 (SBT 2004).

It is unlikely that the EFSR watershed historically supported a large population of Snake River Basin steelhead due to a limited amount of accessible spawning habitat (Ray, pers. com. 2004). Snake River Basin steelhead use the lower mainstem of Herd Creek and accessible tributaries for

migration and rearing. Current populations in the EFSR are very depressed. Only one Snake River Basin steelhead redd was found in lower Herd Creek in 2003, and other EFSR tributaries had similar low reproduction results (SBT 2004).

The IDFG maintains a fish weir on the East Fork Salmon River, upstream of the Herd Creek-East Fork confluence, and approximately 0.25 of a mile upstream of the confluence with Big Boulder Creek. The circa-1984 weir is used to trap adult Snake River Basin steelhead (for egg collection purposes) as directed by the supplementation program at the Sawtooth Hatchery. Snake River spring/summer chinook salmon collection at the weir was suspended in 1997 (IDFG personal communication; ISCC 1995).

A stream habitat inventory that was completed by Trapani (2002) in 1994 reveals that the anadromous fish habitat in Herd Creek (like the East Fork) has potential to sustain salmon populations, with improvements to substrate conditions, water diversions, and passage. Percent fine sediment in spawning gravel was between 20% and 35% in Herd Creek (IDEQ 2003). Herd Creek can carry 222 tons/day of sediment at bankfull and 14.5 tons/day at low flow (USDA-FS 1997). Bank stability of Herd Creek was rated as 73% stable in 1994 (Trapani 2002). Sparse riparian vegetation, (especially on private land) allows the stream to migrate across the valley, reduces pool frequency and complexity, and contributes to streambank erosion (Trapani 2002).

The NOAA Fisheries MPI (NMFS 1996b) provides a tool for assessing the current conditions of various aquatic and riparian habitat elements in the Herd Creek sub-watershed. Use of the matrix (Appendix C) identified several habitat indicators as either at risk or not properly functioning within the action area (e.g. sediment, passage conditions, riparian vegetation, and water quality).

Completed watershed improvement projects in the watershed include a riparian exclosure, constructed in 1980 on BLM managed land. It protects about one mile of Herd Creek above the HC 3 diversion and the confluence with Lake Creek from livestock grazing. Reconstruction of the exclosure in 1990 improved its effectiveness. In 1996, the Forest Service extended the exclosure another mile upstream by constructing additional fence and adding gap fencing in two other tributaries to enhance riparian habitat protection in the allotment. The Shoshone-Bannock Tribes performed riparian restoration plantings in 2002 on private land (downstream of the HC 3 diversion), and plan future riparian revegetation efforts in the sub-watershed. The Herd Creek Bridge (downstream of the HC 3 diversion) was replaced by the BLM in the summer of 2001. Improvements include replacing the box culvert bridge with a pre-fabricated spanning bridge on concrete abutments, and modifying the existing channel to match the natural stream channel width to accommodate a hundred year flow event. The

BLM found that the bridge replacement did not affect the overall baseline conditions in Herd Creek and the downstream reaches of the East Fork and mainstem Salmon River (USDI-BLM 2002). Two culverts were replaced by the BLM, during the summer of 2003, to facilitate fish passage on Lake Creek. Ongoing grazing in the Herd Creek allotment continues to degrade riparian vegetation, bank stability, water temperatures, and water quality. However, the combined effects from BLM and Forest Service exclusion fencing efforts, existing allotment pasture fencing, recently modified grazing prescriptions, and the Shoshone-Bannock Tribes' riparian restoration plantings are expected to improve riparian vegetation along several stream reaches of Herd Creek. One future project to further improve existing diversion and conveyance systems, and fish passage, is the HC 2 Diversion Modification Project, which was proposed by the BLM in 2004.

2.2 Analysis of Effects

Effects of the action are defined as: "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50 CFR 402.02). Direct effects occur at the action area and may extend upstream or downstream based on the potential for impairing the value of habitat for meeting the species' biological requirements or impairing the essential features of critical habitat. Indirect effects are defined in 50 CFR 402.02 as "those that are caused by the proposed action and are later in time, but still are reasonably certain to occur." They include the effects on listed species or critical habitat of future activities that are induced by the proposed action and that occur after the action is completed. "Interrelated actions are those that are part of a larger action and depend on the larger action for their justification"
(50 CFR 403.02). "Interdependent actions are those that have no independent utility apart from the action under consideration" (50 CFR 402.02).

In step 3 of the jeopardy and adverse modification analysis, NOAA Fisheries evaluates the effects of proposed actions on listed species and seeks to answer the question of whether the species can be expected to survive with an adequate potential for recovery. In watersheds where critical habitat has been designated, NOAA Fisheries must make a separate determination of whether the action will result in the destruction or adverse modification of critical habitat (ESA, section 3(3) and section 3(5A)).

2.2.1 Habitat Effects (which may also affect listed species)

NOAA Fisheries will consider any scientifically credible analytical framework for determining an activity's effect. In order to streamline the consultation process and to lead to more consistent effects determinations across agencies, NOAA Fisheries where appropriate recommends that action agencies use the MPI and procedures in NMFS (1996b), particularly when their proposed action would take place in forested montane environments. NOAA Fisheries is working on similar procedures for other environments. Regardless of the analytical method used, if a proposed action is likely to impair properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of impaired habitat toward PFC, it cannot be found consistent with conserving the species.

For the streams typically considered in salmon habitat-related consultations, a watershed is a logical unit for analysis of potential effects of an action (particularly for actions that are large in scope or scale). Healthy salmonid populations use habitats throughout watersheds (Naiman *et al*. 1992), and riverine conditions reflect biological, geological and hydrological processes operating at the watershed level (Bisson *et al.* 1997; Nehlsen *et al.* 1997; and NMFS 1999).

Although NOAA Fisheries prefers watershed-scale consultations due to greater efficiency in reviewing multiple actions, increased analytic ability, and the potential for more flexibility in management practices, often it must analyze effects at geographic areas smaller than a watershed or basin due to a proposed action's scope or geographic scale. Analyses that are focused at the scale of the site or stream reach may not be able to discern whether the effects of the proposed action will contribute to or be compounded by the aggregate of watershed impacts. This loss of analytic ability typically should be offset by more risk averse proposed actions and ESA analysis in order to achieve parity of risk with the watershed approach (NMFS 1999).

The HC 3 Project BA provides an analysis of the effects of the proposed action on Snake River spring/summer chinook salmon and Snake River Basin steelhead and the designated critical habitat for Snake River spring/summer chinook salmon. The effects analysis uses the MPI (Appendix C) and procedures in NMFS (1996b), the information in the BA, and the best scientific and commercial data available to evaluate elements of the proposed action that have the potential to affect the listed fish or essential features of critical habitat.

The effectiveness of the custom-made structure remains somewhat unknown in terms of how it will perform in minimizing sedimentation and improving fish passage under all flow regimes. If the design does not perform as predicted in the BA and contract documents, reinitiation of consultation with NOAA Fisheries may be required and additional design modifications may be necessary.

2.2.1.1. Effects of sedimentation and substrate alteration on Snake River spring/summer chinook salmon and steelhead

The primary concern is potential recruitment of fine sediments into Herd Creek during construction activities replacing the diversion structure. There may also be interim and long-term effects due to increased sedimentation and alteration of stream substrates.

Sediment inputs that exceed a stream's transport ability can become embedded in spawning gravels, greatly reducing salmonid egg and alevin survival. Stream substrates contaminated with fine particles are less or not suitable as future spawning areas, and salmonid populations are typically negatively correlated with the amount of fine sediment in stream substrate (Chapman and McLeod 1987). Excess sedimentation and deposition may also destroy overwintering habitat and pools that act as cover for fry and juveniles, alter production of macroinvertebrate prey species, and reduce total pool volume (various studies summarized in Spence *et al*. 1996).

Excessive concentrations of fine sediments in the redd environment can reduce the survival of embryos and alevins by entombing embryos, reducing dissolved oxygen concentrations, and decreasing the interstitial space. Egg deposition and survival are reduced when sediment fills the interstitial spaces between gravels and prevents the flow of oxygen and the flushing of metabolic wastes. Fine sediment deposited in stream substrates is directly related to chinook salmon egg-to-fry survival. As fine sediment increases above approximately 19%, chinook salmon egg-to-fry survival declines rapidly (Tappel and Bjornn 1983; Chapman and McLeod 1987; Burton *et al*. 1993). Rhodes *et al*. (1994) concluded that survival to emergence for chinook salmon in the Snake River Basin is probably substantially reduced when fine sediment concentrations (<6.4 millimeters in size) in spawning gravel exceed 20%. They recommended suspension of ongoing activities and prohibition of new activities where this standard is exceeded.

Emerging fry can also be trapped and smothered by sediment deposition in the gravels. As sediment becomes deposited in interstitial spaces, rearing habitat for juvenile salmonids is also reduced. Rearing areas are diminished as sediment fills pools and other areas. Sedimentation of deep pools and the coarse substrate that is used for rearing and overwintering limits the space available for anadromous salmonids. Increased sediment load can be detrimental to juvenile salmon not only by causing siltation, but also by introducing suspended particulate matter that interferes with feeding and territorial behavior (Berg and Northcote 1985). Bell (1986) describes a study in which salmonids did not move in streams where the suspended sediment concentration exceeded 4,000 milligrams per liter (mg/L) because of a landslide. Newly emerged fry appear to be more susceptible to even moderate turbidity than older fish. Turbidity in the range of 25-50 NTUs (nephelometric turbidity units) (equivalent to 125-275 mg/L of suspended bentonite clay in water) reduced growth and caused more young salmon and steelhead to emigrate from laboratory streams than did clear water (Sigler *et al*. 1984). Another study observed that juvenile salmon preferred clear and medium turbidity conditions (0 to 4,000 mg/L of suspended sediment), and avoided high suspended sediment conditions (4,000 to 12,000 mg/L). When juveniles were subjected to higher turbidity (>4,000 mg/L), evidence of stress occurred, including an increased rate of opercular movement and "coughing", sediment accumulations on gill filaments, and declines in prey capture success (Cedarholm and Reid 1987). In most cases, suspended sediment-induced vision impairment caused reduced ability of fish to capture prey (Sykora et al. 1972; Berg 1982).

Salmonid physiological responses to high suspended sediment exposure include mucus production on gills and "coughing", to facilitate sloughing of fine particulates (Bams 1969). A study by Everest et al. (1987), concluded that all salmonid species can tolerate the natural variability in sediments, yet their populations can be reduced by persistent sedimentation that exceeds the natural range of variability under which they evolved.

Sedimentation can also kill salmonid prey species, including benthic invertebrates. Fine sediments can interfere with respiration and overwhelm filtering by insects such as some caddisfly (Trichoptera) larvae that employ fine-meshed catch nets for obtaining drifting food particles. The primary effect on benthic invertebrates is the mass smothering of physical habitat by heavy sediment deposition on the streambed, including the loss of interstitial space occupied by burrowing or hyporheic animals (Waters 1995). It is well documented that abundance of benthic invertebrates correlate positively with particle size (sand-gravel-pebble-cobble) (Needham 1928; Pennak and Van Gerpen 1947; Sprules 1947; Kimble and Wesch 1975). However, the more important functional relationship may be between substrate heterogeneity and benthos abundance. Large boulders, bedrock and homogeneous sand or silt exhibit the least amount of benthos abundance; whereas, the greatest abundance is found in composite substrate of heterogeneous pebbles, gravel, and cobbles (Minshall 1984). These relationships generally fit for the principal fish prey insect taxa, including Trichoptera, Plecoptera (stoneflies) and Ephemeroptera (mayflies), that tend to thrive in mixed cobble and pebble riffles.

Existing irrigation methods require that the irrigator perform annual (or more frequent) instream maintenance of the push-up dam using heavy machinery in the wetted ("live") stream channel. This results in regular disturbance and compaction of the stream substrate and increased introduction and suspension of sediment into the water column. Replacing the push-up dam with a permanent structure should improve conditions for spawning and rearing of Snake River spring/summer chinook salmon and steelhead by eliminating regular disturbances and sedimentation associated with instream structure maintenance.

The temporary filling of the conveyance canal with 1000 linear feet of clean fill will not affect Herd Creek because irrigation will cease, the canal will be shut off and dewatered. After construction is completed, including regrading the entire ditch, the fill will be removed to an upland site.

Direct sedimentation effects from the project are anticipated to result from instream work to remove the existing rock push-up dam and install the rock weir, a steel "T" plate (a type of metal grade control structure across the bottom of the low flow notch), and a geotextile membrane. Other instream disturbances include the installation of a metal headgate and ramp flume to regulate and limit flows into the diversion ditch that will improve stream channel flows and fish passage through the action area. In the short-term, removal of materials associated with the push-up dam structure and the armoring of the upstream inlet with rock will also increase turbidity and siltation.

The proposed action would likely cause a short-term increase in turbidity and sedimentation of the substrate in the action area. In-channel activities may also temporarily disrupt fish movements (smolts, juveniles and adults), feeding and survival of developing fry and juveniles, and staging prior to spawning. Young-of-the-year chinook salmon fry may be disturbed by turbid waters, resulting from instream activities, and need to emigrate from the action area. Short-term streambed changes in the action area could reduce cover, thus increasing stress on upstream migrants as they move through the channel section to spawning habitat.

Some riparian vegetation will be removed during project construction, particularly at the site of keying the new diversion structure into the streambank. Short-term water quality impacts may result from instream activities by increases in turbidity and sedimentation. Sedimentation from this activity will be reduced by erosion control devises and eventual replanting.

The effects of increasing suspended and substrate sediment noted above can occur in the action area, but will likely be minimized. Working in the wet with a backhoe or excavator will increase sediment inputs in the short-term, yet the natural variability in sedimentation is not anticipated to be exceeded with BMPs and conservation measures in place (Ray, pers. com. 2004). A water pump with 3/32 inch screens on the intake hose (NMFS 1996a) will be used to siphon the turbid water from the immediate work area into the adjoining wetland to facilitate the filtration of sediments. This will reduce sedimentation effects on water quality in the affected reach and downstream. The alternative coffer dam option, while providing a drier work environment, requires the excavation of a fish bypass channel that may potentially introduce more sediment into Herd Creek and degrade more riparian and stream habitat at this particular site, compared to working in the water. A fish bypass channel would create higher pulse sediment loading events while opening the bypass into the main channel and during the closing/decommissioning phase (Johnson, pers. com. 2004).

By adding armoring upstream of the new diversion structure, headcuts and other major channel migrations may be prevented; thus, preventing downstream sedimentation effects. Armoring the upstream inlet with rocks may decrease available spawning substrate in the immediate area and disrupt the natural sediment transportation processes. Like the placement of rocks in the weir, the inlet armoring will temporarily increase turbidity and downstream fine sediment deposition. To minimize other downstream sediment and substrate effects, the rocks will be keyed into the stream bottom close to maintain the inlet’s cross-section..

The conservation measures, such as the use of a water pump in the action area with 3/32 inch screens on the intake hose (NMFS 1996a), and the 14-day duration and timing (June 15 to July 31 work window) of instream work, are expected to greatly reduce the amount of fines entering the stream, or being remobilized from the substrate during instream work.

Construction will occur during low water conditions (anticipated at 12 to 18 cubic feet per second during the designated work window), and the use of BMPs will minimize the potential amount of sediment introduced to the water column and the instream substrate. These measures will avoid the likelihood of long-term adverse effects to spawning and rearing habitat.

There are also anticipated interim adverse affects resulting from an accumulation of spawning gravels immediately upstream of the new weir structure and a reduction in spawning gravels immediately downstream for the first few years following construction until natural substrate depositions reach dynamic equilibrium within the affected stream reach (Cluer, pers. com. 2004).

The project will disturb existing refugia and resting cover for fry, juveniles, and adults; however, those characteristics should be reestablished as the channel adjusts to the changes. Instream habitat will be improved by the construction of the weir because scour pools will be created on the downstream side of the weir. The pools will establish new resting areas for juveniles and adults.

2.2.1.2. Effects of chemical contamination on Snake River spring/summer chinook salmon and steelhead

As with all construction activities, accidental releases of fuel, oil, and other contaminants may occur. Operation of the backhoes, excavators, and other equipment requires the use of fuel, lubricants, etc., which, if spilled into a waterbody or into the adjacent riparian zone, can injure or kill aquatic organisms. Petroleum-based contaminants (such as fuel, oil, and some hydraulic fluids) contain poly-cyclic aromatic hydrocarbons (PAHs), which can be acutely toxic to salmonids at high levels of exposure and can also cause chronic lethal and acute and chronic sublethal effects to aquatic organisms (Neff 1985).

The existing diversion and irrigation methods require annual or more frequent instream maintenance of the push-up dam using heavy machinery. These instream maintenance activities increase chronic exposure to pollutants and the likelihood of a fuel spill into Herd Creek and downstream reaches of the East Fork and mainstem Salmon River. No petroleum or chemical release contingency plans are in place under the present push-up dam maintenance. The new, permanent structure for the HC 3 diversion will not require similar instream disturbances on a regular basis.

Heavy equipment will be used for project implementation in and near Herd Creek. Excavation in the stream channel associated with the removal and installation of diversion structures will elevate the risk for chemical contamination of the aquatic environment within the action area. Because the potential for chemical contamination should be localized and brief, the probability of direct mortality is negligible.

Risks of petroleum or other chemical releases into Herd Creek exist, however, these will be minimized by fuel handling and spill contingency plans described in the final contract documents and the BA. No waste disposal of petroleum products is allowed in or near the action area. Fueling of equipment will occur at least 100 feet away from any waterbody. The BA and the final contract documents for the HC 3 Project include vehicle inspection and leakage prevention measures. The designated staging area for construction equipment will be approximately 50 yards downstream of the new headgate, along the right bank of Herd Creek in a meadow area. Equipment staging will be at least 100 feet from Herd

Creek, will include spill containment

equipment as described in the BA, and these requirements will be included in the final contract documents. No heavy equipment will be staged near or used in the HC 3 Project area after project completion.

2.2.1.3. Effects of instream work and fish passage on Snake River spring/summer chinook salmon and steelhead

Adult salmonids typically move through a stream system at night and during low-intensity daylight hours. Salmonids normally move rapidly through fast water and rest in deep-water pool habitat (Trapani 2002). Instream work can disrupt passage and other fish behaviors. However, using an appropriate work window may minimize disturbances to ESA-listed salmonids. Work windows designed for Herd Creek were established by the Upper Salmon Basin Water Project (USBWP 2003).

The existing push-up dam structure impedes fish passage, particularly at summer low flows. Regular dam maintenance may disrupt fish migrations, spawning activities, and other fish behaviors. The existing headgate allows unregulated flow into the conveyance system and could conceivably dewater the entire reach during low-flow periods. Replacing the push-up dam with a permanent structure will improve conditions for upstream and downstream migrating fish by eliminating regular instream maintenance.

Because there are 11 active Snake River spring/summer chinook redds currently in the action area (four redds in the close proximity upstream and seven in close proximity downstream of where the proposed permanent weir structure will be installed), the Shoshone-Bannock Tribes' Fisheries Department is performing periodic snorkel surveys in Herd Creek to confirm sac-fry emergence prior to implementation of instream work, and ensure safe fry emigration from the action area when instream activities commence. No instream activities will take place until fry have emerged from their redds and developed sufficiently to emigrate safely from the action area. Daily stream surveys will also be performed to ensure the action area is free of adult spawners and redds under construction prior to initiation of instream activities. Work will cease and NOAA Fisheries will be notified when a fish or redd is found in the action area. Work will not resume until discussions with NOAA Fisheries and the Shoshone-Bannock Tribes determine that it is safe to do so, or if an alternative work window is warranted.

Fish passage will be maintained through the action area as the old diversion is removed and the new structure is installed, leaving the main channel for upstream and downstream anadromous salmonid movements. Instream activities will last no more than two weeks total. Work will begin midstream and focus on construction of one side of the weir structure at a time, providing for fish passage at all times (refer to Section 1.2 “Proposed Action” for full description).

During construction, the hours of instream work are restricted to allow for some period of noise-free and other disturbance-free time to facilitate Snake River spring/summer chinook salmon and Snake River Basin steelhead movements. Working in the wet during daylight hours (6:00 AM to 8:00 PM Mountain Standard Time (MST)) only will provide for safe fish passage throughout the project implementation period.

Work will take place between June 15 and July 31, 2004, with the intention to avoid direct effects on salmonid spawning activities and embryo development, with fish passage maintained during construction. This work window will also avoid direct effects to out-migrating salmonid smolts (typically occurring during the peak hydrograph that begins in early May and declines mid-to-late June); and direct effects on Snake River spring/summer chinook salmon spawning, which typically occurs in the second week of August (Ray, pers. com. 2004). In the Herd Creek sub-watershed, chinook fry emergence typically occurs in early June (Ray, pers. com. 2004), and Snake River Basin steelhead fry emerge during the months of June and early August, depending on aquatic thermal units and general water quality conditions (USBWP 2003). Steelhead redds were not found in the action area (SBT 2004). The proposed action will, therefore, avoid potential adverse effects on steelhead redds or emerging fry.

The new weir will be constructed with 3-4 foot diameter rock placed in a linear fashion across the stream channel. Armoring the inlet of the seasonal overflow channel with rock will reduce the risk that the stream may change course as a result of high flows and bypass the new weir structure, and so prevent obstruction of flows or fish passage.

Installing the “V”-weir structure will result in creating holding pools on the downstream side of the rock weir. The new structure will concentrate flows through the low flow fish notch and create a well-defined thalweg, enabling fish passage during low flow periods. The new headgate will provide regulated flows through the diversion ditch and improve instream flows and fish passage, while the upstream armoring of the seasonal overflow channel streambed will reduce the risk that the stream may change course as a result of high flows and bypass the new weir structure, and so prevent obstruction of flows or fish passage. Most notably, the removal and replacement of the push-up dam across Herd Creek will eliminate a fish passage obstruction.

Operation of the permanent replacement HC 3 diversion structure should allow improved fish passage by the design of the low-flow notch, and will eliminate annual instream maintenance, or replacement of the diversion structure.

2.2.1.4 Effects of riparian vegetation and stream temperature on Snake River spring/summer chinook salmon and steelhead

Woody riparian vegetation provides large wood to the stream, which encourages the creation of rearing and spawning areas. Riparian vegetation also provides water quality functions (*e.g.* temperature control and nutrient transformation), bank stability, detritus (insect and leaf input, small wood for substrate for insects), microclimate formation, floodplain sediment retention and vegetative filtering, and recharge of the stream hyporheic zone.

Streamside vegetation benefits to aquatic communities can include overhanging cover and shade, cool water temperature, and large woody debris recruitment, leading to increased instream cover and water depth. Increased bank stability and complexity, buffer and filter for erosion control and reduced sediment delivery, and a source of terrestrial food items for fish are also benefits of a fully functioning riparian community.

Chronic riparian disturbances are associated with regular instream dam maintenance. The new permanent weir structure will eliminate the need for regular dam maintenance.

Negligible amounts of streambank vegetation will be removed as a result of project activities. A minimal amount may be lost or damaged resulting from keying in the new diversion structure into the bank. Any area disturbed by construction activities will be replanted with native vegetation, appropriate for the local vegetation community type. Revegetation will occur immediately following project completion if adequate growing time allows, or by the following growing season. No net reduction of riparian vegetation is expected with the project conservation measures in place.

A long-term benefit to chinook salmon and steelhead habitat would result from the establishment of riparian vegetation, since the need for regular dam maintenance activities will be eliminated, and associated vegetation disturbances will be avoided.

2.2.1.5. Effects of instream flows on Snake River spring/summer chinook salmon and steelhead

Maintaining minimum desirable instream flows is important for adult staging, spawning, egg and fry development, juvenile rearing habitat, and facilitating fish movements. This becomes crucial in streams, such as Herd Creek, with irrigation diversions and other water withdrawals in arid climates.

The existing headgate allows unregulated flow into the conveyance system and could conceivably dewater the entire reach during low-flow periods. Increased net flows should result, since the irrigation withdrawals will be controlled by the new headgate structure.

During construction, the landowner will not irrigate, the conveyance system will be dry, and his water appropriation will remain instream. Otherwise, flows will remain the same during project implementation. Flows will be concentrated on the opposite side of the channel from where they are working.

The new headgate structure will regulate the flows diverted into the irrigation channel and improve net instream flows and fish passage, while the armoring of the upstream inlet will

facilitate channel flows and fish passage through the permanent diversion structure. Off-channel improvements and efficiencies to the conveyance and irrigations systems should result in reductions in diverted stream flows.

2.2.2 Species Effects

Under existing practices with the push-up dam, there are no contingency plans or fish salvage operations. Although there is no direct evidence of fish kills or other forms of take, the potential for fish mortality is greater under the existing design and ongoing maintenance of the HC 3 push-up diversion structure, because of the regular disturbance of the streambed, and the possibility of crushing fishes or redds with heavy equipment operating periodically in the wetted stream channel. The existing headgate allows unregulated flow into the conveyance system and could conceivably dewater the entire reach during low-flow periods.

The effect that a proposed action has on particular essential features or MPI pathways can be translated into a likely effect on population growth rate. In the case of this consultation, it is not possible to quantify an incremental change in survival for Snake River spring/summer chinook salmon and Snake River Basin steelhead.

While population growth rates have been calculated at the large ESU scale, changes to the environmental baseline from the proposed action were described only within the action area. An action that improves habitat in a watershed, and thus helps meet essential habitat feature requirements, may therefore increase lambda[5] for the populations of the ESUs in the action area.

Based on the effects described above, the HC 3 Project will have short-term negative effects on Snake River spring/summer chinook salmon and Snake River Basin steelhead due to sedimentation of substrate and instream disturbances, primarily from replacement of the push-up dam with a permanent structure. Some riparian vegetation will be removed during project construction, yet resulting

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[5] Lambda is the annual rate of population change (See Appendices A & B)

sedimentation will be reduced by erosion control devises and eventual replanting. Risks of water quality degradation by petroleum or other chemical releases into Herd Creek will be minimized by fuel handling and spill contingency plans. There are also anticipated interim adverse affects immediately downstream of the new structure associated with the temporary loss of spawning gravels, and anticipated positive changes immediately upstream, as natural substrate depositions reach dynamic equilibrium within the affected stream reach (Cluer, pers. com. 2004). With this proposal, there will be a net positive effect on the survival and recovery of Snake River spring/summer chinook salmon and Snake River Basin steelhead. Although the positive influences of this individual project would be very difficult to quantify, even over time, the combined effects of this project, similar diversion structure projects, and other anadromous salmonid habitat improvements in Herd Creek, its tributaries, the EFSR, and the mainstem Salmon River should be measurable in increased number of redds and increases in outmigrations for ESA-listed anadromous species.

2.2.3 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." These activities within the action area also have the potential to adversely affect the listed species and critical habitat. Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being reviewed through separate section 7 consultation processes. Federal actions that have already undergone section 7 consultations have been added to the description of the environmental baseline in the action area.

State, Tribal, and local government actions will likely be in the form of legislation, administrative rules or policy initiatives. Government and private actions may encompass changes in land and water uses including ownership and intensity, any of which could adversely affect listed species or their habitat. Government actions are subject to political, legislative, and fiscal uncertainties.

Changes in the economy have occurred in the last 15 years, and are likely to continue, with less large-scale resource extraction, more targeted extraction, and significant growth in other economic sectors. Growth in new businesses, primarily in the technology sector, is creating urbanization pressures and increased demands for buildable land, electricity, water supplies, waste-disposal sites, and other infrastructure (ODAS 1999).

Economic diversification has contributed to population growth and movement, and this trend is likely to continue. Such population trends will result in greater overall and localized demands for electricity, water, and buildable land in the action area; will affect water quality directly and indirectly; and will increase the need for transportation, communication, and other infrastructure (ODAS 1999). The impacts associated with these economic and population demands will probably affect habitat features such as water quality and quantity, which are important to the survival and recovery of the listed species. The overall effect will likely be negative, unless carefully planned for and mitigated.

Existing activities that occur within the immediate vicinity of the HC 3 Project include livestock grazing, water withdrawals for hay field and cropland irrigation, and other agricultural uses.
Dramatic changes are not expected in land use patterns from the existing, rural lifestyle that concentrates on livestock and forage production on farmsteads and ranches, and includes low intensity, dispersed recreation. The proposed action creates a permanent, hard structure for diverting water for irrigation and livestock watering as a replacement for a more temporary push-up dam and leaking, earthen conveyance ditch, and thus increases the likelihood that land uses will remain the same for a longer period of time as farming and grazing practices become more efficient and cost-effective.

The IDEQ will establish Total Maximum Daily Loads (TMDLs) in the Snake River Basin, a program regarded as having positive water quality effects. The TMDLs are required by court order, so it is reasonably certain that they will be set. The State of Idaho has created an Office of Species Conservation to work on subbasin planning and to coordinate the efforts of all state offices addressing natural resource issues. Demands for Idaho's groundwater resources have caused groundwater levels to drop and reduced flow in springs for which there are senior water rights. The Idaho Department of Water Resources has begun studies and promulgated rules that address water right conflicts and demands on a limited resource. The studies have identified aquifer recharge as a mitigation measure with the potential to affect the quantity of water in certain streams, particularly those essential to listed species.

Plans for the replacement of the diversion structure at HC 2 are also being reviewed. This action, while likely to have a net positive effect on stream substrate and fish passage conditions (as the proposed action does) will be subject to section 7 consultation with the BLM, and thus is not considered a cumulative effect in this consultation. There may be a potential increase in Tribal angling pressure and harvest during their annual season(s), with the improvement of fish passage and instream salmonid habitat and the predicted increases in Herd Creek and Lake Creek fish populations.

2.2.4 Consistency with Listed Species ESA Recovery Strategies

Recovery is defined by National Marine Fisheries Service (NMFS) regulations (50 CFR 402) as an "improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4 (a)(1) of the Act." Recovery planning is underway for listed Pacific salmon in the Northwest with technical recovery teams identified for each domain. Recovery planning will help identify measures to conserve listed species and

increase the survival of each life stage. NOAA Fisheries also intends that recovery planning identify the areas/stocks most critical to species conservation and recovery and thereby evaluate proposed actions on the basis of their effects on those areas/stocks.

Until the species-specific recovery plans are developed, the FCRPS Opinion and the related December 2000 *Memorandum of Understanding Among Federal Agencies Concerning the Conservation of Threatened and Endangered Fish Species in the Columbia River Basin* (together these are referred to as the Basinwide Salmon Recovery Strategy) provides the best guidance for judging the significance of an individual action relative to the species-level biological requirements. In the absence of completed recovery plans, NOAA Fisheries strives to ascribe the

appropriate significance to actions to the extent available information allows. Where information is not available on the recovery needs of the species, either through recovery planning or otherwise, NOAA Fisheries applies a conservative substitute.

NOAA Fisheries has specific commitments to uphold under the Basinwide Salmon Recovery Strategy. The proposed action is consistent with the specific commitments and primary objectives of the Basinwide Salmon Recovery Strategy, including improving fish passage and stream channel conditions for listed salmon and steelhead (Appendix B).

2.2.5 Summary of Effects

2.2.5.1 Habitat Effects

The proposed action is not likely to impair properly functioning habitat, to appreciably reduce the functioning of already impaired habitat, nor likely to retard the long-term progress of impaired habitat toward PFC. The HC 3 Project will eliminate the negative effects (primarily sedimentation) of the current operations of the diversion structure and the regular instream maintenance of the push-up dam with heavy equipment, and will improve fish passage through this reach of Herd Creek. Short-term degradation of the critical habitat associated with the construction phase of the HC 3 Project is considered only limited and temporary in its nature and is offset by utilizing IDEQ BMPs for reducing erosion, and avoiding or minimizing the introduction of petroleum products into the waters of Herd Creek and tributaries. A water pump with 3/32 inch screens on the intake hose (NMFS 1996a) will be used to siphon the turbid water from the immediate work area into the adjoining wetlands to facilitate the filtration of sediments. This will reduce sedimentation effects on water quality in the affected reach and downstream while working in the water. These conservation measures will minimize short-term adverse affects to substrate, riparian vegetation and water quality.

The proposed action is consistent with the specific habitat-based commitments and primary objectives of the Basinwide Salmon Recovery Strategy and the goal of the PCSRF. The Shoshone-Bannock Tribes and BOR involvement in the HC 3 Project is, in part, helping to offset anadromous salmonid habitat degradation in the Salmon River Basin, including Herd Creek and the greater EFSR watershed. In particular, the project should help improve rearing and fish passage habitat and protect downstream spawning and nursery habitat. Net long-term habitat benefits will outweigh short-term negative effects incurred from the proposed project activities.

2.2.5.2 Species Effects

Based on the habitat effects described above, the proposed action will not reduce, and may increase, survival of ESA-listed Snake River spring/summer chinook salmon and Snake River Basin steelhead. Working in the water only during daylight hours (6:00 AM to 8:00 PM MST) will facilitate fish passage throughout the project implementation period. Stream surveys will be conducted by the Shoshone-Bannock Tribes to monitor for fish and completed redds or redds-in-progress prior to initiation of daily instream

activities. Work will cease and NOAA Fisheries will be notified when a fish or redd is found in the action area. Work will not resume until discussions with NOAA Fisheries and the Shoshone-Bannock Tribes determine that it is safe to do so, or if an alternative work window is warranted.

According to the latest Snake River spring/summer chinook redd count data, there has been a recent increase of returning fish and higher fecundity, from 22 redds in 2001, 59 redds in 2002, to 74 redds in 2003 (SBT 2004). The new HC 3 diversion structure may help facilitate further incremental increases in the return numbers by providing improvements to fish passage via the low-flow fish notch, the creation of holding pools (on the downstream side of the rock weir) for better channel habitat, and a deeper thalweg that will also provide improved passage conditions for all flow regimes. The new headgate and ramp flume will regulate and limit diverted flows into the irrigation ditch. This will result in improved stream channel flows and fish passage; whereas, the existing headgate allows unregulated flow into the conveyance system and could conceivably dewater the entire reach during low-flow periods.

The proposed action will not appreciably reduce survival of ESA-listed Snake River spring/summer chinook salmon and Snake River Basin steelhead in the short-term and can increase survival and production in the long-term. Removal of the existing push-up dam and installation of the new, permanent HC 3 diversion structure will occur in the wetted channel during seasonal low flows (after spring runoff) to minimize sedimentation effects on ESA-listed anadromous salmonids, and prior to the spawning season to reduce or eliminate harm, harassment or mortality to fish.

2.3 Conclusions

2.3.1 Critical Habitat Conclusion

After reviewing the current condition of the critical habitat, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects in the action area, it is NOAA Fisheries' opinion that the HC 3 Project is not likely to destroy or adversely modify designated critical habitat for Snake River spring/summer chinook salmon.

2.3.2 Species Conclusion

NOAA Fisheries has determined that, based on the available information, the effects of the proposed action are not likely to jeopardize the continued existence of the Snake River Basin steelhead and the Snake River spring/summer chinook salmon.
NOAA Fisheries used the best available scientific and commercial data to analyze the effects of the proposed action on the biological requirements of the species relative to the environmental baseline, together with cumulative effects. NOAA Fisheries applied its evaluation methodology to the proposed action and found that it could cause short-term degradation of anadromous salmonid habitat, and increases in sedimentation and turbidity. NOAA Fisheries expects that construction-related effects could temporarily alter the normal feeding and sheltering behaviors of juvenile steelhead, or chinook salmon during the proposed action. Some direct or delayed mortality of juvenile chinook salmon or steelhead are expected as a result of instream activities, should chinook or steelhead be present in those areas during the proposed action. Beneficial water quality and hydrologic effects from the replacement of the HC 3 diversion, headgate and upstream flow improvements at the inlet of the seasonal overflow channel are also expected. Overall, NOAA Fisheries expects long-term, beneficial effects on the species from improved fish passage and hydrologic conditions as a result of the diversion replacement.

NOAA Fisheries' conclusions are based on the following: (1) Any increases in sedimentation and turbidity in the Herd Creek project reach will be short-term and minor in scale, due to the use of BMP's and other conservation measures, and would not change or worsen existing conditions for stream substrate in the action area; (2) instream work will occur in the June 15 to July 31 work window during low water in Herd Creek; (3) daily stream surveys will occur to determine presence of fish, completed redds or redds-in-progress, minimizing the likelihood of harm, harassment or fish mortality during instream construction activities; (4) long-term, beneficial effects will result from the proposed replacement of the diversion structure; and, (5) the proposed action is not likely to impair properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of impaired habitat toward proper functioning condition essential to long-term survival and recovery at the population ESU scale.

2.4 Reinitiation of Consultation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required if: (1) the amount or extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; (2) new information reveals effects of the action may affect listed species in a way not previously considered; (3) the action is modified in a way that causes an effect on listed species that was not previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease, pending conclusion of the reinitiated consultation.

2.5 Incidental Take Statement

The ESA at section 9 [16 USC 1538] prohibits take of endangered species. The prohibition of take is extended to threatened anadromous salmonids by section 4(d) rule [50 CFR 223.203]. Take is defined by the statute as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." [16 USC 1532(19)] Harm is defined by regulation as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering." [50 CFR 222.102] Harass is defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering." [50 CFR 17.3] Incidental take is defined as "takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant." [50 CFR 402.02] The ESA at section 7(o)(2) removes the prohibition from any incidental taking that is in compliance with the terms and conditions specified in a section 7(b)(4) incidental take statement [16 USC 1536].

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

2.5.1 Amount or Extent of Take

The proposed action is reasonably certain to result in incidental take of the listed species. NOAA Fisheries is reasonably certain the incidental take described here will occur because: (1) the listed species are known to occur in the action area; and, (2) the proposed action is likely to cause impacts to critical habitat significant enough to impair feeding, breeding, migrating, or sheltering for the listed species. Despite the use of best scientific and commercial data available, NOAA Fisheries cannot quantify a specific amount of incidental take of individual fish or incubating eggs for this action. In lieu of an amount of take, NOAA Fisheries identifies the extent of take (i.e., the specific area in which take is expected to occur). The extent of take is anticipated to include the aquatic and associated riparian habitats affected by the proposed action (activities associated with the removal and replacement of the HC 3 diversion structure on Herd Creek). The extent of take includes the instream work areas at HC 3 and the area within 75 yards downstream. The lethal take of adult Snake River spring/summer chinook salmon and/or Snake River Basin steelhead, their existing redds or redds-in-progress is not anticipated.

Fish salvage and incidental take of fish caused by handling in fish salvage efforts are authorized by NOAA Fisheries, and if necessary, work shall stop immediately and fish salvage should proceed in coordination with NOAA Fisheries, FWS, and the Shoshone-Bannock Tribes. Juveniles and/or adults are authorized to be captured, held live, and/or moved to a safe location outside of the influences of the project under the participation and supervision of the Shoshone-Bannock Tribes and NOAA Fisheries.

If the proposed action results in an exceedance of take described in this incidental take statement, NOAA Fisheries would need to reinitiate consultation. The authorized take includes only take

caused by the proposed action within the action area as defined in this Opinion. It does not authorize violations of the Clean Water Act and the State of Idaho Surface Water Quality Standards.

2.5.2 Reasonable and Prudent Measures

Reasonable and Prudent Measures (RPMs) are non-discretionary measures to minimize take, that may or may not already be part of the description of the proposed action. They must be implemented as binding conditions for the exemption in section 7(o)(2) to apply. NOAA Fisheries has the continuing duty to regulate the activities covered in this incidental take statement. If NOAA Fisheries fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contract documents, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. NOAA Fisheries believes that activities carried out in a manner consistent with these RPMs, except those otherwise identified, will not necessitate further site-specific consultation. Activities which do not comply with all relevant RPMs will require further consultation.

NOAA Fisheries believes that the following RPMs are necessary and appropriate to minimize take of listed fish resulting from implementation of the action. These RPMs would also minimize adverse effects on designated critical habitat.

NOAA Fisheries shall ensure that the Shoshone-Bannock Tribes:

1. Minimize the impact of incidental take by performing daily stream surveys to determine presence or absence of anadromous salmonids and their completed or in-progress

redds in the action area prior to initiation of instream work.

2. Minimize the impact of incidental take from construction activities by implementing BMPs for controlling sedimentation and other forms of non-point source pollution associated with construction as outlined in the contract documents and specifications. This includes phases of the proposed project that occur outside of the Herd Creek stream channel, modifications to the conveyance system and accessing the action area, so that such onsite disturbances associated with construction do not degrade ESA-listed salmonid habitat or harm listed fishes.

3. Minimize the impact of incidental take by adhering to the work window outlined in the Opinion, implementing the work during daylight hours (6:00 AM to 8:00 PM (MST)), and by adhering to spill response and contingencies described in the BA and agreed to at the February 4 and March 26, 2004, meetings. This includes proper implementation of containment and cleanup procedures in all waters that connect to Herd Creek in the event of a fuel spill or other unanticipated accident or pollution event associated with the HC 3 Project. This is in addition to spill response and contingency plans covered by the BA, contract documents, and the February 4 and March 26, 2004, consultation meetings.

4. Minimize the extent of impacts on riparian vegetation and stream conditions, and when impacts are unavoidable, replace or restore lost habitat functions through implementation of measures identified in the BA.

5. Monitor the effects of the proposed action to determine the actual project effects on listed fish (50 CFR 402.14 (I)(3)). Monitoring should detect adverse effects of the proposed action, assess the actual levels of incidental take in comparison with anticipated incidental take documented in the Opinion, and detect circumstances where the level of incidental take is exceeded. Monitoring shall also address fish passage and ensure that it is improved with the replacement of the push-up dam and the operation of the improved HC 3 diversion structure. To ensure effectiveness of implementation of the RPMs, all fish removal and handling, water drafting, spill containment, prevention, and control plans, and hazardous materials sites shall be monitored and evaluated both during and following construction, and meet criteria as described below in the terms and conditions.

6. Include all terms and conditions with any project-associated documents, such as a grant, permit or contract issued for purposes of implementing the action described herein.

2.5.3 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the action must be implemented in compliance with the following terms and conditions, which implement the RPMs described above for each category of activity. These terms and conditions are non-discretionary.

1. To implement RPM #1, above, NOAA Fisheries shall ensure that the Shoshone-Bannock Tribes implement all necessary stream surveys to track the presence or absence of ESA-listed anadromous salmonids in the action area as identified in the final BA. In addition,

    a. Fisheries biologists will perform periodic snorkeling surveys in the action area (beginning in June 2004) to determine fry emergence and mobility to take refuge outside of the action area prior to initiation of instream work. Instream work will not occur until fry emergence is complete and fry development is sufficient to allow for safe escapement and the ability of fry to avoid project-related activities and effects.

    b. A fisheries biologist will be onsite during the instream project activities. The fisheries biologist will perform daily stream surveys of the action area, to ensure absence of ESA-listed anadromous salmonids, their completed redds or redds-in-progress prior to commencement of in-channel work.

    c. NOAA Fisheries shall ensure that the Shoshone-Bannock Tribes cease work if the presence of ESA-listed anadromous salmonids or redd development is found within the confines of the action area or in close proximity downstream of the HC 3 Project. NOAA Fisheries shall ensure that the Shoshone-Bannock Tribes notify NOAA Fisheries, and the agencies will determine under what specific timing and other requirements work can resume.

2. To implement RPM #2, above, NOAA Fisheries shall ensure that the Shoshone-Bannock Tribes implement all BMPs for controlling sedimentation and other forms of non-point source pollution associated with construction as identified in the final BA and contract documents. This includes off-channel project-related work such as modifications to the HC 3 diversion ditch, replacement of the headgate structure, and staging construction equipment. In addition,

    a. Fording the stream is not anticipated to complete project activities, and only permitted, if necessary, at the discretion of the Shoshone-Bannock Tribes and NOAA Fisheries personnel.

b. A water pump with 3/32 inch screens on the intake hose (NMFS 1996a) will be used to siphon the turbid water from the immediate work area into the adjoining wetland. This will reduce sedimentation effects on water quality in the affected reach and downstream while working in the wet.

c. The selected staging site for construction equipment will be approximately 50 yards downstream of the new headgate structure in the meadow area, on the descending right bank (road-side) of Herd Creek. Equipment will be staged at least 100 feet from Herd Creek with appropriate spill containment in place.

d. Upon completion of the project, a copy of all monitoring reports on the effectiveness of implementing and maintaining the site-specific water quality and other environmental conditions are provided to NOAA Fisheries.

3. To implement RPM #3, above, NOAA Fisheries shall ensure that the Shoshone-Bannock Tribes adhere to the work window days as outlined in the Opinion, work during daylight hours (6:00 AM to 8:00 PM (MST)), and implement all spill response and contingency plans identified in the final BA and contract documents. This includes proper implementation of containment and cleanup procedures in any ditch and other waters that connect to Herd Creek if a spill or other unanticipated accident occurs associated with the HC 3 Project. In addition,

   a. In the case of a pollution event or release including, but not limited to a fuel spill, notification of NOAA Fisheries, FWS and the Idaho Department of Environmental Quality is required.

   b. The Spill Response/Contingency Plans, as delineated in the BA, contract documents, and the February 4 and March 26, 2004, consultation meeting consensus decisions will also be applied to the conveyance system (ditch) and other waters that connect to Herd Creek in the event of a spill or other unanticipated release of pollutants.

   c. In the case of the necessity of salvage, all work must stop and the Shoshone-Bannock Tribes shall notify NOAA Fisheries and the FWS.

   d. If any fish removal activities occur, a report shall be provided to NOAA Fisheries (within 3 months following completion) that contains all pertinent information for reporting take.

   e. If a sick, injured, or dead specimen of a threatened or endangered species is found, the finder must notify the Vancouver Field Office of NOAA Fisheries

Law Enforcement at (360) 418-4246. The finder also has the responsibility to carry out instructions provided by Law Enforcement.

f. The finder must take care in handling sick or injured specimens to avoid further injury of individuals, and

g. In the event that any individuals of a listed species are killed, care will be provided in handling the dead specimens to ensure proper scientific preservation of the biological material in the best possible state for later necropsy and for ensuring that evidence intrinsic to the specimen(s) is not unnecessarily disturbed and remains intact for further investigation.

h. NOAA Fisheries shall ensure that the Shoshone-Bannock Tribes and their contractors and other agents shall adhere to the calendar date constraints as outlined in the final BA and contract documents, which limit the timing of all in-water work to the established work window of June 15 to July 31, 2004.

i. NOAA Fisheries shall ensure that the Shoshone-Bannock Tribes and their contractors and other agents shall adhere to a daily schedule that leaves the stream undisturbed from 8:00 PM to 6:00 AM (MST).

j. Exceptions to the daily time and calendar date constraints may be accommodated by NOAA Fisheries if supported by additional biological and other site-specific data and a sound ecological rationale is presented. These exceptions and modifications require written concurrence from NOAA Fisheries.

k. Project operations will cease under high flow conditions that may incur unprecedented habitat degradation and sedimentation in the action area, except for efforts to avoid or minimize resource damage.

l. All water intakes (pumps) used for the project will have a fish screen installed, operated and maintained according to NOAA Fisheries' fish screen criteria (NMFS 1996a).[6]

4. To implement RPM #4, above, NOAA Fisheries shall ensure that the Shoshone-Bannock Tribes implement all conservation measures identified in the final BA and contract documents. These are identified in Section 1.2 of this Opinion. In addition,

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6 National Marine Fisheries Service, *Juvenile Fish Screen Criteria* (revised February 16, 1995) and *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm).

a. “Waterway” is defined as any perennial, intermittent, or anthropogenic channel or water conveyance system.

b. Alteration of native vegetation will be minimized. Where possible, native vegetation will be removed and stockpiled in a manner that ensures that roots are left intact and then replanted when appropriate.

c. All exposed areas within the riparian corridor will be replanted with native riparian species appropriate for the local floral community.

d. If reseeding or replanting cannot occur immediately following completion of construction, soil conservation measures such as matting or straw bales shall be placed to minimize soil erosion until spring, when the area will be replanted.

e. Revegetated areas will be monitored during the first fall following replanting and reseeding, the following spring, and then annually for five years. Any dead plantings of woody vegetation will be replanted to achieve a minimum of 80% survival after three years, and grasses will be reseeded if not reestablished. Access by cattle and other livestock will be excluded for at least three years following construction to allow riparian vegetation to reestablish.

f. Revegetated areas will be monitored to evaluate the reestablishment of desired riparian plant species and the avoidance of their displacement by exotic and/or undesirable species. Weeds will be hand pulled whenever feasible, otherwise, NOAA Fisheries will be contacted to discuss possible use of herbicides and appropriate treatment protocols.

g. A report documenting the results of riparian vegetation monitoring will be prepared annually and submitted to NOAA Fisheries (Jan Pisano, Branch Chief, 100 Courthouse Drive, Suite F, Salmon, ID 83467 or (208) 756-6498 facsimile) by the following January 31.

h. The Shoshone-Bannock Tribes shall inform NOAA Fisheries of the planned construction schedule to allow NOAA Fisheries to observe any construction activities. Contact: NOAA Fisheries, ATTN: Jan Pisano, Branch Chief, 100 Courthouse Drive, Suite F, Salmon, Idaho 83467; or call (208) 756-6478; or facsimile (208) 756-6498; or email at: jan.pisano@noaa.gov

5. To implement RPM #5, above, NOAA Fisheries shall ensure the Shoshone-Bannock Tribes have a qualified fish biologist onsite at all times during instream construction to monitor fish passage conditions and adverse effects of the proposed action, assess and immediately report to NOAA Fisheries all instances of take and detect circumstances where the level of incidental take is exceeded as covered by ESA, including harm, or lethal take of ESA-listed species, and in particular, anadromous fishes (Snake River spring/summer chinook salmon and Snake River Basin steelhead). In addition, NOAA Fisheries shall ensure the Shoshone-Bannock Tribes collect the following ecological data and meet the following additional requirements:

   a. Collect baseline information on the fish populations and salmonid habitat features for each life history stage represented in Herd Creek in the vicinity of the HC 3 Project and downstream to its mouth and confluence with the EFSR.

   b. Fish population and salmonid habitat data will be collected during construction and after project completion. Monitoring of the effects of the project will occur for five years following final construction and initiation of operations of the new structure for water diversion and conveyance.

   c. Annual (by January 31 of the following calendar year) and final monitoring and evaluation reports will be provided to NOAA Fisheries (attention: Jan Pisano, Branch Chief, 100 Courthouse Drive, Suite F, Salmon, ID 83467 or (208) 756-6498 facsimile).

   d. Fish passage will be maintained for any adult or juvenile salmonid species present in the action area during construction, and after construction for the life of the project. Monitoring will address fish passage and ensure that it is improved with the replacement of the push-up dam and operation of the improved permanent weir structure. NOAA Fisheries shall ensure that the Shoshone-Bannock Tribes:

      (1) Maintain unimpaired fish passage throughout the HC 3 Project implementation period, and will adhere to the plans outlined in the BA and contract documents.

      (2) Affirm that the "V-weir" is properly functioning during high and low flows to enable adult and juvenile anadromous salmonids to pass through the action area in an unimpeded manner. If the structure or other design features of HC 3 diversion that enable fish passage need to be modified or repaired, NOAA Fisheries shall ensure that the Shoshone-Bannock Tribes shall notify NOAA Fisheries and FWS and

obtain written concurrence.

(3) The Shoshone-Bannock Tribes, their contractors, and agents affirm that Herd Creek remains undisturbed from instream work, nearby blasting, and work in the riparian zone in the vicinity of the HC 3 diversion structure between 8:00 PM and 6:00 AM (MST) during the approved work window.

(4) If the instream flows and depths do not allow fish passage for all freshwater life stages during the allowed work window, instream operations shall cease and NOAA Fisheries immediately contacted. Based on impassable instream flows and depths, NOAA Fisheries shall ensure the Shoshone-Bannock Tribes propose a feasible alternative to allow unimpeded fish passage in the vicinity of the HC 3 Project. Written permission from NOAA Fisheries is required to proceed in an alternative fashion that maintains the necessary instream flows and depths for fish passage during construction.

e. The diversion structure shall be visually inspected at least annually to ensure structural integrity and unobstructed fish passage through the low flow notch. Wasteway operations will be visually inspected at least annually to ensure fish are not attracted to the ditch. If operation of the wasteway changes or fish attraction develops, the Shoshone-Bannock Tribes will coordinate with the landowner to change operations and prevent fish attraction. If, at any time, a determination is made that the structure is not performing as intended, NOAA Fisheries and FWS will be included in discussions with the BOR regarding repair and/or modifications. Items that shall be monitored are:

(1) The low-flow notch will be inspected to ensure that debris, such as rocks or logs, is not blocking fish passage.

(2) The low-flow notch will be inspected to ensure it is functioning as designed over the entire flow regime of Herd Creek, with particular attention to water depth and velocity through the notch, and especially under the lowest flow conditions.

6. All terms and conditions shall be included in any permit, grant, or contract issued for the implementation of the action described in this Opinion.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

3.1 Statutory Requirements

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan.

Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (section 305(b)(2)).

- NOAA Fisheries must provide conservation recommendations for any Federal or state action that may adversely affect EFH (section 305(b)(4)(A)).

- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NOAA Fisheries EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (section 305(b)(4)(B)).

The EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA section 3). For the purpose of interpreting this definition of EFH: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

The EFH consultation with NOAA Fisheries is required for any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action may adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects on EFH.

3.2 Identification of EFH

Pursuant to the MSA the Pacific Fishery Management Council (PFMC) has designated EFH for three species of Federally-managed Pacific salmon: chinook (*Oncorhynchus tshawytscha*); coho (*O. kisutch*); and Puget Sound pink salmon (*O. gorbuscha*) (PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable anthropogenic barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of potential adverse effects to these species' EFH from the proposed action is based, in part, on this information.

3.3 Proposed Actions

The proposed action and action area are detailed above in Sections 1.2 and 1.3 of this document. The action area includes habitats that are designated as EFH for various life-history stages of chinook salmon (Table 2).

Table 2. Species of Fishes and Life Stages with Designated EFH in the Action Area

Species	Eggs	Larvae	Young Juvenile	Juvenile	Adult	Spawning
Chinook salmon	X	X	X	X	X	X

Table 2 shows the fish species and life stages of fish with EFH in the HC 3 Project action area. No ground fish or coastal pelagic species EFH will be affected by this proposed project.

3.4 Effects of Proposed Action on EFH

The habitat requirements for chinook salmon have been evaluated and have been found to be the same as the habitat requirements for Snake River spring/summer chinook salmon and Snake River Basin steelhead. As described in detail in Section 2.2.1 of this document, the proposed action may result in short-, interim, and long-term adverse effects on a variety of habitat parameters. These adverse effects are:

1. Increases in siltation and substrate embeddedness associated with increased loading and mobilization of sediments, especially fine materials during removal of the existing rock push-up dam. This is considered a short-term adverse effect downstream of the HC 3 Project.

2. Increase in turbidity and sedimentation associated with increased stream substrate and bank disturbance during the construction of the permanent "V"-weir structure. This is considered a short-term adverse effect at and downstream of the HC 3 Project.

3. A temporary disruption of migration timing through the stream reach of Herd Creek in the general vicinity of the HC 3 Project.

4. Accumulation of spawning gravels immediately upstream of the new weir structure and a reduction in spawning gravels immediately downstream. This is considered a longer term (or interim) fluvial and channel morphological effect for the first few years following construction, until natural substrate depositions reach dynamic equilibrium within the affected stream reach.

5. A temporary disruption in feeding ability and other activities for fry and juvenile salmon associated with increases in turbidity interfering with visual predation and siltation.

6. A longer term disruption of benthic habitats is likely in Herd Creek upstream and downstream of the HC 3 Project. This may cause a decrease in benthic invertebrate production until natural flow regimes and events bring characteristic channel substrate habitat back into a new equilibrium.

3.5 Conclusion

NOAA Fisheries concludes that the proposed action may adversely affect designated EFH for chinook salmon.

3.6 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions that may adversely affect EFH. NOAA Fisheries shall ensure the Shoshone-Bannock Tribes will implement the conservation measures described in the final BA and contract documents. NOAA Fisheries believes that these measures are sufficient to minimize, to the maximum extent practicable, EFH effects. Although, these conservation measures are not sufficient to fully address the remaining adverse effects on EFH, specific terms and conditions outlined in Section 2.5.3 are generally applicable to designated EFH for chinook salmon, and do address these adverse effects. Consequently, NOAA Fisheries recognizes that the proposed actions include measures to avoid
effects on EFH, and additional non-discretionary conservation measures are required by this Opinion as RPMs and terms and conditions. No further conservation measures are necessary for EFH.

3.7 Statutory Response Requirement

Pursuant to the MSA (section 305(b)(4)(B)) and 50 CFR 600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

3.8 Supplemental Consultation

NOAA Fisheries must reinitiate EFH consultation if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(l)).

4. REFERENCES

Bams, R.A. 1969. Adaptations of sockeye salmon associated with incubation in stream gravels. Pages 71-87 *in* Northcote, T.G., editor. Symposium on salmon and trout in streams. H.R. MacMillan Lectures in Fisheries, University of British Columbia, Vancouver, British Columbia.

Bell, M.C. 1986. Fisheries handbook of engineering requirements and biological criteria. U.S. Army Corps of Engineers, Office of the Chief of Engineers, Fish Passage Development and Evaluation Program, Portland, Oregon.

Berg, L. and T.G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences 42:1410-1417.

Beven, D., J. Harville, P. Bergman, T. Bjornn, J. Crutchfield, P. Klingeman, and J. Litchfield. 1994. Snake River Salmon Recovery Team: Final recommendations to National Marine Fisheries Service (NMFS). Dated May 1994.

Bisson, P.A., G.H. Reeves, R.E. Bilby and R.J. Naiman. 1997. Watershed management and Pacific salmon: Desired future conditions. Pages 447-474 *in* Stouder, D.J., P.A. Bisson, and R.J. Naiman, editors. Pacific Salmon and Their Ecosystems: Status and Future Options. Chapman and Hall, New York.

Biological Review Team (BRT). 1998. Status review update for West Coast chinook salmon (*Oncorhynchus tshawytscha*) from Puget Sound, Lower Columbia River, Upper Willamette River, and UCR Spring-Run ESUs. West Coast Chinook Salmon BRT, Seattle, Washington.

BRT. 2003. Draft report of updated status of listed ESUs of salmon and steelhead. Available online at: http://www.nwfsc.noaa.gov/trt/brt/brtrpt.cfm.

Bjornn, T.C., A. Brusven, M.P. Molnau, F.J. Watts, R.W. Wallace, D.R. Neilson, M.F. Sandine, and L.C. Stuehrenberg. 1974. Sediment in streams and its effects on aquatic life. University of Idaho, Water Resources Research Institute, Research Technical Completion Report Project B-025-IDA, Moscow, Idaho.

Bjornn, T.C., M.A. Brusven, M.P. Molnau, J.H. Milligan, R.A. Klamt, E. Chacho, and C. Shaye. 1977. Transport of granitic sediment in streams and its effects on insects and fish. University of Idaho, College of Forestry, Wildlife and Range Sciences, Bulletin 17, Moscow, Idaho.

Bonneville Power Administration (BPA). 1987. East Fork Salmon River habitat enhancement project: Project 83-359. Prepared for the Shoshone-Bannock Tribes Fisheries Department. Annual report. Fort Hall, Idaho.

Burton, T.A., K.E. Vollmer, and S.J. Kozel. 1993. Assessment of streambank stability and utilization monitoring data for Bear Valley and Johnson Creek Basin cattle allotments. Unpublished report. Avail. U.S. Forest Service, Boise National Forest, Boise, Idaho, 83702.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarcino. 1996. Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California. NOAA-NWFSC-27. Available from NOAA Fisheries, Northwest Fisheries Center, Coastal Zone and Estuaries Studies Division, 2725 Montlake Blvd., E., Seattle, Washington 98112-2097. 261 pp.

Cedarholm, C.J., and L.M. Reid. 1987. Impact of forest management on coho salmon (*Oncorhynchus kisutch*) populations in the Clearwater River, Jefferson County, Washington: a project summary. Pages 373-398 *in* E.O. Salo and T.W. Cundy, editors. Streamside management: forestry and fishery interactions. University of Washington, College of Forest Research, Seattle, Washington.

Chapman, D.W. and K.P. McLeod. 1987. Development of criteria for fine sediments in the Northern Rockies Ecoregion. Work Assignment 2-73. Battelle Columbus Laboratories. EPA Contract

No. 68-01-6986. 279 pp.

Cluer, B. March 2004. NOAA Fisheries Southwest Region Fluvial-Geomorphologist. Personal Communication

Coutant, C.C. 1999. Perspectives on Temperature in the Pacific Northwest's Fresh Waters. Environmental Sciences Division Publication 4849 (ORNL/TM-1999/44), Oak Ridge National Laboratory, Oak Ridge, Tennessee. 108 pp.

Culp, J.M., S.J. Walde, and R.W. Davies. 1983. Relative importance of substrate particle size and detritus to stream benthic macroinvertebrate microdistribution. Canadian Journal of Fisheries and Aquatic Sciences 40:1568-1574.

Emmett, W.W. 1975. The channels and waters of the upper Salmon River area, Idaho. Geological Survey Professional Paper 870-A, U.S. Government Printing Office, Washington, D.C. 116 pp.

Everest, F.H., R.L. Beschta, J.C. Scrivener, K.V. Koski, J.R. Sedell, and C.J. Cederholm. 1987. Fine sediment and salmonid production; a paradox. Pages 98-142 *in* E.O. Salo and T.W. Cundy, editors. Streamside management: forestry and fishery interactions. University of Washington, College of Forest Research, Seattle, Washington.

Endangered Species Act (ESA) of 1973. 16 USC 1531-1544, as amended.

Federal Caucus. 2000. Conservation of Columbia Basin Fish: Final Basinwide Salmon Recovery Strategy. http://www.salmonrecovery.gov December.

Fish Passage Center. 2001a. http://www.fpc.org/adult_history/ytd-lgr.htm

Fish Passage Center. 2001b. http://www.fpc.org/fpc_docs/200-01.pdf

Fish Passage Center. 2002. Fish Passage Center smolt data, current and historical. Available from: Fish Passage Center, 2501 S.W. First Ave., Suite 230, Portland, Oregon 97201-4752. 52 pp + appendices. Also available online at: http://www.fpc.org/fpc_docs/Annual_FPC_Report/FPC2002_Annual_Report.pdf

Fish Passage Center. 2003. Fish Passage Center adult data, current and historical. Available from: Fish Passage Center, 2501 S.W. First Ave., Suite 230, Portland, Oregon 97201-4752. Also available online at: http://www.fpc.org

Healey, M.C. 1991. Timing and relative intensity of size-selective mortality of juvenile chum salmon (*Oncorhynchus keta*) during early sea life. Canadian Journal of Fisheries and Aquatic Sciences 39:952-957.

Henjum, M.G., J.R. Karr, D.L. Bottom, D.A. Perry, J.C. Bednarz, S.G. Wright, S.A. Beckwitt and E. Beckwitt. 1994. Interim protection for late-successional forests, fisheries and watersheds. National Forests east of the Cascade Crest, Oregon and Washington. A report to the United States Congress and the President. The Wildlife Society, Bethesda, Maryland.

Idaho Department of Environmental Quality (IDEQ). 1999. 1998 303(d) List. Idaho Division of Environmental Quality. Surface Water Program. January. 473 pp.

IDEQ. 2003. Upper Salmon River Subbasin Assessment and TMDL. IDEQ, Boise, Idaho. January 2003. 216 pp.

Idaho Department of Fish and Game (IDFG). 2004. Idaho Conservation Data Center species database. Boise, Idaho.

Idaho Soil Conservation Commission (ISCC). 1995. Model Watershed plan. Lemhi, Pahsimeroi, and East Fork of the Salmon River. November 1995.

Independent Scientific Group. 1996. Return to the River: Restoration of salmonid fishes in the Columbia River Ecosystem. Northwest Power Planning Council. Portland, Oregon. 500 pp.

Johnson, John L. March-May 2004. NOAA Fisheries Northwest Region Hydrology Engineer. Hydropower Division. Personal Communication.

Kimble, L.A. and T.A. Wesch. 1975. Relationships between selected physical parameters and benthic community structure in a small mountain stream. University of Wyoming, Water Resources Research Institute, Water Resources Series 55. Laramie, Wyoming.

Lee, D.C., J.R. Sedell, B.E. Rieman, R.F. Thurow, and J.E. Williams. 1997. Broadscale assessment of aquatic species and habitats. Volume III, Chapter 4. U.S. Forest Service, Pacific Northwest Research Station. General Technical Report PNW-GTR-405. Portland, Oregon.

Magnuson-Stevens Fishery Conservation and Management Act (MSA). Public Law 104-267. The Sustainable Fisheries Act of 1996 reauthorized and amended MSA.

Maser, C., and J.R. Sedell. 1994. From the Forest to the Sea: The Ecology of Wood in Streams, Rivers, Estuaries, and Oceans. St. Lucie Press, Delray Beach, Florida.

Matthews, G.M. and R.S. Waples. 1991. Status review for Snake River spring and summer chinook salmon. NMFS F/NWC/-200. Available from NOAA Fisheries, Northwest Fisheries Science Center, Coastal Zone and Estuaries Studies Division, 2725 Montlake Blvd., E., Seattle, Washington 98112-2097. 75 pp.

McClelland, W.T. and M.A. Brusven. 1986. Effects of sedimentation on the behavior and distribution of riffle insects in a laboratory stream. Aquatic Insects 2:161-169.

McElhany, P., M. Ruckleshaus, M.J. Ford, T. Wainwright, and E. Bjorkstedt. 2000. Viable salmon populations and the recovery of evolutionarily significant units. NOAA Technical Memorandum NMFS-NWFSC-42. Available from NOAA Fisheries, Northwest Fisheries Science Center, 2725 Montlake Blvd., E., Seattle, Washington 98112-2097.

McIntosh, B.A., J.R. Sedell, J.E. Smith, R.C. Wissmar, S.E. Clarke, G.H. Reeves, and L.A. Brown. 1994. Management history of eastside ecosystems: Changes in fish habitat over 50 Years, 1935 to 1992. U.S. Forest Service, Pacific Northwest Research Station. General Technical Report PNW-GTR-321. Portland, Oregon.

Minshall, G.W. 1984. Aquatic insect-substratum relationships. Pages 358-400 *in* V.H. Resh, and D.M. Rosenberg, editors. The ecology of aquatic insects. Praeger Publishers, New York.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of chinook Salmon from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum, NMFS-NWFSC-35. Available from NOAA Fisheries, Northwest Fisheries Science Center, Coastal Zone and Estuaries Studies Division, 2725 Montlake Blvd. E., Seattle, Washington 98112-2097. 443 pp.

Naiman, R.J., T.J. Beechie, L.E. Benda, D.R. Berg, P.A. Bisson, L.H. MacDonald, M.D. O'Connor, P.L. Olson, and E.A. Steel. 1992. Fundamental elements of ecologically healthy watersheds in the Pacific Northwest Coastal Ecoregion. Pages 127-188. *In*: R.S. Naiman, editor. Watershed Management — Balancing Sustainability and Environmental Change. Springer-Verlag, New York.

National Marine Fisheries Service (NMFS), NOAA Fisheries, Northwest Region. 1995. Juvenile fish screen criteria. Revised February 16, 1995 [Environmental & Technical Services Division]. Portland, Oregon. Available at: http://www.nwr.noaa.gov/1hydrop/nmfscrit1.htm

NMFS. 1996a. Addendum: Juvenile fish screen criteria for pump intakes. NOAA Fisheries, Northwest Region, Environmental & Technical Services Division. (Issued May 9, 1996). (http://www.nwr.noaa.gov/1hydrop/pumpcrit1.htm)

NMFS. 1996b. Making Endangered Species Act determinations of effect for individual and grouped actions at the watershed scale. NOAA Fisheries, Northwest Region, Habitat Conservation Program. Portland, Oregon.

NMFS. 1999. The Habitat Approach. Implementation of Section 7 of the Endangered Species Act for actions affecting the habitat of Pacific anadromous salmonids. NOAA Fisheries, Northwest Region, Habitat Conservation and Protected Resources Divisions. Portland, Oregon. (Issued August 26, 1999).

NMFS. 2000. Biological Opinion -- Reinitiation of consultation on operation of the Federal Columbia River Power System, including the juvenile fish transportation program, and 19 Bureau of Reclamation projects in the Columbia Basin. NOAA Fisheries, Northwest Region, Hydro Program. Portland, Oregon. (Issued December 21, 2000)

NMFS. 2002. Interim abundance and productivity targets for interior Columbia Basin salmon and steelhead listed under the Endangered Species Act (ESA). NOAA Fisheries, Northwest Region. (Issued April 4, 2002).

National Research Council. 1996. Upstream—Salmon and Society in the Pacific Northwest. National Academy Press, Washington, D.C.

Needham, P.R. 1928. A quantitative study of the fish food supply in selected areas. Pages 192-206. *In* A Biological Survey of the Oswego River System, Supplemental to Seventeenth Annual Report, 1927. New York Conservation Department. Albany, New York.

Nehlsen, W. 1997. Prioritizing watersheds in Oregon for salmon restoration. Restoration Ecology 5(4S):25-43.

Neff, J. M. 1985. Polycyclic aromatic hydrocarbons. Pages 416-454. *In*: G.M. Rand and S.R Petrocelli, editors. Fundamentals of aquatic toxicology, methods and applications. Hemisphere Publishing Corporation (McGraw-Hill International Book Company). Washington D.C., New York, London.

Oregon Department of Administrative Services (ODAS). 1999. Oregon economic and revenue forecast. Vol. XIX. No. 2. Office of Economic Analysis. Salem, Oregon.

Oregon Progress Board. 2000. Oregon State of the Environment Report 2000. Oregon Progress Board. Salem, Oregon.

Pacific Fishery Management Council (PFMC). 1999. Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and identification of essential fish habitat, adverse impacts and recommended conservation measures for salmon. Pacific Fishery Management Council. Portland, Oregon.

Pennak R.W. and E.D. Van Gerpen. 1947. Bottom fauna production and physical nature of the substrate in a northern Colorado trout stream. Ecology 28:42-48.

Pollard, H. May 2004. NOAA Fisheries, Boise State Office Senior Sustainable Fisheries Biologist. Sustainable Fisheries Division. Personal Communication.

Ray, H.L. February and March 2004. Shoshone-Bannock Tribes Salmon River Habitat Enhancement Program Manager. Personal Communication.

Ray, H.L., K. Bacon and L. Denny. 2004. Salmon River habitat enhancement program annual report 2002. Shoshone-Bannock Tribes, Fort Hall, Idaho. Prepared for: U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Portland, Oregon. Project No. 94-50, Contract Number 94B134143.

Reeves, G.H., L.E. Benda, K.M. Burnett, P.A. Bisson, and J.R. Sedell. 1995. A disturbance-based approach to maintaining and restoring freshwater habitats of evolutionarily significant units of anadromous salmonids in the Pacific Northwest. American Fisheries Society Symposium 17:334-349.

Regetz, J. 2003. Landscape-level constraints on recruitment of chinook salmon (*Oncorhynchus tshawytscha*) in the Columbia River Basin, USA. Aquatic Conservation: Marine and Freshwater Ecosystems. 13: 35-49.

Rhodes, J.J., D.A. McCullough, and F.A. Espinosa, Jr. 1994. A coarse screening process for potential application in ESA consultations. Columbia River Intertribal Fish Commission. Prepared under NMFS/BIA Inter-Agency Agreement 40ABNF3. December.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado.

Sedell, J.R. and J.L. Froggatt. 1984. Importance of streamside forests to large rivers: The isolation of theWillamette River, Oregon, USA, from its floodplain by snagging and streamside forest removal. Internationale Vereinigung fur theoretische und angewandte Limnologie

Verhandlungen 22:1828-1834.

Shoshone-Bannock Tribes (SBT). 2004. Fall 2003 Snake River spring/summer chinook salmon and Snake River steelhead redd survey report. Fish and Wildlife Department. Shoshone-Bannock Tribes. Fort Hall, Idaho.

Sigler, J.W., T.C. Bjornn, and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of steelhead and coho salmon. Transactions of the American Fisheries Society 113:142-150.

Spence, B.C, G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An Ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp. Corvallis, Oregon.

Sprules, W.M. 1947. An ecological investigation of stream insects in Algonquin Park, Ontario. University of Toronto Studies, Biological Series 56. Publication of the Ontario Fisheries Research Laboratory 69:1-80.

Sykora, J.L., E.J. Smith, and M. Synak. 1972. Effect of lime neutralized iron hydroxide suspensions on juvenile brook trout (*Salvelinus fontinalis* Mitchill). Water Research 6:935-950.

Tappel, P.D. and T.C. Bjornn. 1983. A new method for relating size of spawning gravel to salmonid embryo survival. North American Journal of Fisheries Management 3:123-135.

Trapani, J. 2002. Upper Salmon Basin Watershed Project. Stream habitat inventory report. Lemhi, Pahsimeroi, and East Fork Salmon River, Idaho. February 2002. Upper Salmon Basin Watershed Project, Salmon, Idaho. 64 pp. (Also available online at: http://www.modelwatershed.org/).

Upper Salmon Basin Watershed Project (USBWP). Draft 2003. Draft Upper Salmon Basin instream work windows for chinook salmon, steelhead trout, bull trout, and westslope cutthroat trout. IDFG, NOAA Fisheries, USFS Salmon-Challis National Forest, BLM Challis Resource Area, USFWS, and USBWP interagency team.

USDA - FS. 1997. Herd Creek Watershed Analysis. Salmon-Challis National Forest and Bureau of Land Management-Challis Resource Area. October 1997.

USDI - BLM (Bureau of Land Management). 1998. Challis Resource Area. Proposed Resource Management Plan and Final Environmental Impact Statement (2 Volumes). BLM/ID/PT-96/008+1610-1790, October 1998. U.S. Government Printing Office. 714 pp.

USDI - BLM. 1999. Steelhead Section 7 watershed assessment for the East Fork of the Salmon

River. November 1999. Challis, Idaho.

USDI - BLM. 2002. Reinitiation of consultation for the East Fork Salmon River Section 7 watershed biological assessment. USDI BLM - Challis Field Office of the Upper Columbia - Salmon Clearwater District, November 2002. 96 pp.

Waters, T.F. 1995. Sediment in Streams: Sources, Biological Effects and Control. American Fisheries Society, Monograph 7. Bethesda, Maryland.

Wissmar, R.C., J.E. Smith, B.A. McIntosh, H.W. Li, G.H. Reeves, and J.R. Sedell. 1994. Ecological health of river basins in forested regions of Eastern Washington and Oregon. General Technical Report PNW-GTR-326. U.S. Forest Service, Pacific Northwest Research Station. Portland, Oregon. 65 pp.

APPENDIX A
BIOLOGICAL REQUIREMENTS, CURRENT STATUS, AND TRENDS: TWELVE COLUMBIA RIVER BASIN EVOLUTIONARILY SIGNIFICANT UNITS

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A.1 OVERVIEW OF STATUS OF SPECIES AND CRITICAL HABITAT

Appendix A provides, for each of the 12 Columbia River basin evolutionarily significant units (ESUs), a description of the species, critical habitat designations, a general life history, and a detailed discussion of population dynamics and distribution. Table A-1 provides a summary of each salmon species listed and proposed for listing under the Endangered Species Act (ESA). Table A-2 provides a summary of critical habitat designations under ESA.

Table A-1. Summary of salmon species listed and proposed for listing under the ESA.

Species	Evolutionarily Significant Unit	Present Status	Federal Register Notice	
Chinook Salmon	Sacramento River Winter	Endangered	59 FR 440	1/4/94
(*O. tshawytscha*)	Snake River Fall	Threatened	57 FR 14653	4/22/92
	Snake River Spring/Summer	Threatened	57 FR 14653	4/22/92
	Central Valley Spring	Threatened	64 FR 50393	9/16/99
	California Coastal	Threatened	64 FR 50393	9/16/99
	Puget Sound	Threatened	64 FR 14308	3/24/99
	Lower Columbia River	Threatened	64 FR 14308	3/24/99
	Upper Willamette River	Threatened	64 FR 14308	3/24/99
	Upper Columbia River Spring	Endangered	64 FR 14308	3/24/99
Chum Salmon	Hood Canal Summer-run	Threatened	64 FR 14508	3/25/99
(*O. keta*)	Columbia River	Threatened	64 FR 14508	3/25/99
Coho Salmon	Central California Coastal	Threatened	61 FR 56138	10/31/96
(*O. kisutch*)	S. Oregon/ N. California Coastal	Threatened	62 FR 24588	5/6/97
	Oregon Coastal	Threatened	63 FR 42587	8/10/98
Sockeye Salmon	Snake River	Endangered	56 FR 58619	11/20/91
(*O. nerka*)	Ozette Lake	Threatened	64 FR 14528	3/25/99
Steelhead	Southern California	Endangered	62 FR 43937	8/18/97
(*O. mykiss*)	South-central California	Threatened	62 FR 43937	8/18/97
	Central California Coast	Threatened	62 FR 43937	8/18/97
	Upper Columbia River	Endangered	62 FR 43937	8/18/97
	Snake River Basin	Threatened	62 FR 43937	8/18/97
	Lower Columbia River	Threatened	63 FR 13347	3/19/98
	California Central Valley	Threatened	63 FR 13347	3/19/98
	Upper Willamette River	Threatened	64 FR 14517	3/25/99
	Middle Columbia River	Threatened	64 FR 14517	3/25/99
Cutthroat Trout	Umpqua River	Endangered	61 FR 41514	8/9/96
Sea-run	Southwest Washington/Columbia River	Proposed Threatened	64 FR 16397	4/5/99
(*O. clarki clarki*)				

Table A- 2. Summary of critical habitat designations under the ESA.

Species	Evolutionarily Significant Unit	Federal Register Notice	
Chinook Salmon (*O. tshawytscha*)	Sacramento River Winter	58 FR 33212	6/16/93
	Snake River Fall	58 FR 68543	12/28/93
	Snake River Spring/Summer	58 FR 68543	12/28/93
	Revised:	64 FR 57399	10/25/99
	Central Valley Spring	65 FR 7764	3/9/98
	California Coastal	65 FR 7764	3/9/98
	Puget Sound	65 FR 7764	2/16/00
	Lower Columbia River	65 FR 7764	2/16/00
	Upper Willamette River	65 FR 7764	2/16/00
	Upper Columbia River Spring	65 FR 7764	2/16/00
Chum Salmon (*O. keta*)	Hood Canal Summer-run	65 FR 7764	2/16/00
	Columbia River	65 FR 7764	2/16/00
Coho Salmon (*O. kisutch*)	Central California Coastal	64 FR 24049	5/5/99
	S. Oregon/ N. California Coastal	64 FR 24049	5/5/99
	Oregon Coastal	65 FR 7764	2/16/00
Sockeye Salmon (*O. nerka*)	Snake River	58 FR 68543	12/28/93
	Ozette Lake	65 FR 7764	2/16/00
Steelhead (*O. mykiss*)	Southern California	65 FR 7764	2/16/00
	South-central California	65 FR 7764	2/16/00
	Central California Coast	65 FR 7764	2/16/00
	Upper Columbia River	65 FR 7764	2/16/00
	Snake River Basin	65 FR 7764	2/16/00
	Lower Columbia River	65 FR 7764	2/16/00
	California Central Valley	65 FR 7764	2/16/00
	Upper Willamette River	65 FR 7764	2/16/00
	Middle Columbia River	65 FR 7764	2/16/00
Cutthroat Trout Sea-run (*O. clarki clarki*)	Umpqua River	63 FR 1388	1/9/98
	Southwest Washington/Columbia River	none proposed	

A.2 SPECIES DESCRIPTIONS AND CRITICAL HABITAT DESIGNATIONS

A.2.1 Chinook Salmon

A.2.1.1 Snake River Spring/Summer Chinook Salmon

The Snake River (SR) spring/summer chinook salmon ESU, listed as threatened on April 22, 1992 (57 FR 14653), includes all natural-origin populations in the Tucannon, Grande Ronde, Imnaha, and Salmon rivers. Some or all of the fish returning to several of the hatchery programs are also listed including those returning to the Tucannon River, Imnaha, and Grande Ronde hatcheries, and to the Sawtooth, Pahsimeroi, and McCall hatcheries on the Salmon River. Critical habitat was designated for SR spring/summer chinook salmon on December 28, 1993 (58 FR 68543), and was revised on October 25, 1999 (64 FR 57399).

A.2.1.2 Snake River Fall Chinook Salmon

The SR fall chinook salmon ESU, listed as threatened on April 22, 1992 (57 FR 14653), includes all natural-origin populations of fall chinook in the mainstem Snake River and several tributaries including the Tucannon, Grande Ronde, Salmon, and Clearwater rivers. Fall chinook from the Lyons Ferry Hatchery are included in the ESU but are not listed. Critical habitat was designated for SR fall chinook salmon on December 28, 1993 (58 FR 68543).

A.2.1.3 Upper Columbia River Spring-Run Chinook Salmon

The Upper Columbia River (UCR) spring-run chinook salmon ESU, listed as endangered on March 24, 1999 (64 FR 14308), includes all natural-origin, stream-type chinook salmon from river reaches above Rock Island Dam and downstream of Chief Joseph Dam, including the Wenatchee, Entiat, and Methow River basins. All chinook in the Okanogan River are apparently ocean-type and are considered part of the UCR summer- and fall-run ESU. The spring-run components of the following hatchery stocks are also listed: Chiwawa, Methow, Twisp, Chewuch, and White rivers and Nason Creek. Critical habitat was designated for UCR spring-run chinook salmon on February 16, 2000 (65 FR 7764).

A.2.1.4 Upper Willamette River Chinook Salmon

The Upper Willamette River (UWR) chinook salmon ESU, listed as threatened on March 24, 1999 (64 FR 14308), occupies the Willamette River and tributaries upstream of Willamette Falls, in addition to naturally produced spring-run fish in the Clackamas River. UWR spring chinook salmon is one of the most genetically distinct chinook groups in the Columbia River (CR) basin. Fall chinook salmon spawn in the upper Willamette but are not considered part of the ESU because they are not native. None of the hatchery populations in the Willamette River was listed, although five spring-run hatchery stocks were included in the ESU. Critical habitat was designated for UWR chinook salmon on February 16, 2000 (65 FR 7764).

A.2.1.5 Lower Columbia River Chinook Salmon

The Lower Columbia River (LCR) chinook salmon ESU, listed as threatened on March 24, 1999 (64 FR 14308), includes all natural-origin populations of both spring- and fall-run chinook salmon in tributaries to the Columbia River from a transition point located east of the Hood River, Oregon, and the White Salmon River, Washington, to the mouth of the Columbia River at the Pacific Ocean and in the Willamette River below Willamette Falls, Oregon (excluding spring-run chinook salmon in the Clackamas River). Not included in this ESU are stream-type spring chinook salmon found in the Klickitat River (which are considered part of the Mid-Columbia River spring-run ESU) or the introduced Carson spring chinook salmon strain. Tule fall chinook salmon in the Wind and Little White Salmon rivers are included in this ESU, but not introduced upriver bright fall chinook salmon populations in the Wind, White Salmon, and Klickitat rivers. The Cowlitz, Kalama, Lewis, Washougal, and White Salmon rivers constitute the major systems on the Washington side; the lower Willamette and Sandy rivers are foremost on the Oregon side. Most of this ESU is represented by fall-run fish; there is some question whether any natural-origin spring chinook salmon persist in this ESU. Fourteen hatchery stocks were included in the ESU; one was considered essential for recovery (Cowlitz River spring chinook) but was not listed. Critical habitat was designated for LCR chinook salmon on February 16, 2000 (65 FR 7764).

A.2.2 Steelhead

A.2.2.1 Snake River Steelhead

The SR steelhead ESU, listed as threatened on August 18, 1997 (62 FR 43937), includes all natural-origin populations of steelhead in the Snake River basin of southeast Washington, northeast Oregon, and Idaho. None of the hatchery stocks in the Snake River basin is listed, but several are included in the ESU. Critical habitat was designated for SR steelhead on February 16, 2000 (65 FR 7764).

A.2.2.2 Upper Columbia River Steelhead

The UCR steelhead ESU, listed as endangered on August 18, 1997 (62 FR 43937), includes all natural-origin populations of steelhead in the Columbia River basin upstream from the Yakima River, Washington, to the U.S./Canada border. The Wells Hatchery stock is included among the listed populations. Critical habitat was designated for UCR steelhead on February 16, 2000 (65 FR 7764).

A.2.2.3 Middle Columbia River Steelhead

The Middle Columbia River (MCR) steelhead ESU, listed as threatened on March 25, 1999 (64 FR 14517), includes all natural-origin populations in the Columbia River basin above the Wind River, Washington, and the Hood River, Oregon, including the Yakima River, Washington. This ESU includes the only populations of winter inland steelhead in the United States (in the Klickitat River, Washington, and Fifteenmile Creek, Oregon). Both the Deschutes River and Umatilla River hatchery stocks are included in the ESU, but are not listed. Critical habitat was designated for MCR steelhead on February 16, 2000 (65 FR 7764).

A.2.2.4 Upper Willamette River Steelhead

The UWR steelhead ESU, listed as threatened on March 25, 1999 (64 FR 14517), consists of all natural-origin populations in the Willamette River and its tributaries upstream of Willamette Falls to the Calapooia River, inclusive. None of the hatchery stocks was included as part of the listed ESU. Critical habitat was designated for UWR steelhead on February 16, 2000 (65 FR 7764).

A.2.2.5 Lower Columbia River Steelhead

The LCR steelhead ESU, listed as threatened on March 19, 1998 (63 FR 13347), consists of all natural-origin populations in tributaries to the Columbia River between the Cowlitz and Wind rivers, Washington, and the Willamette and Hood rivers, Oregon, inclusive. NMFS specifically excluded three river basins: 1) the Willamette River basin above Willamette Falls, 2) the Little White Salmon River, and 3) the Big White Salmon River, Washington (61 FR 41545). Among hatchery stocks, late-spawning Cowlitz River Trout Hatchery and late-spawning Clackamas River ODFW stock No. 122 are part of the ESU, but are not considered essential for recovery. Critical habitat was designated for LCR steelhead on February 16, 2000 (65 FR 7764).

A.2.3 Chum Salmon

A.2.3.1 Columbia River Chum Salmon

The Columbia River (CR) chum salmon ESU, listed as threatened on March 25, 1999 (64 FR 14508), includes all natural-origin chum salmon in the Columbia River and its tributaries in Washington and Oregon. None of the hatchery populations is included as part of the listed ESU. Critical habitat was designated for CR chum salmon on February 16, 2000 (65 FR 7764).

A.2.4 Sockeye Salmon

A.2.4.1 Snake River Sockeye Salmon

The SR sockeye salmon ESU, listed as endangered on November 20, 1991 (56 FR 58619), includes populations of sockeye salmon from the Snake River basin, Idaho (extant populations occur only in the Salmon River subbasin). Under NMFS' interim policy on artificial propagation (58 FR 17573), the progeny of fish from a listed population that are propagated artificially are considered part of the listed species and are protected under ESA. Thus, although not specifically designated in the 1991 listing, SR sockeye salmon produced in the captive broodstock program are included in the listed ESU. Given the dire status of the wild population under any criteria (16 wild and 264 hatchery-produced adult sockeye returned to the Stanley basin between 1990 and 2000), NMFS considers the captive broodstock and its progeny essential for recovery. Critical habitat was designated for SR sockeye salmon on December 28, 1993 (58 FR 68543).

A.3 GENERAL LIFE HISTORIES

A.3.1 Chinook Salmon

The chinook salmon is the largest of the Pacific salmon. The species' distribution historically ranged from the Ventura River in California to Point Hope, Alaska, in North America, and in northeastern Asia from Hokkaido, Japan, to the Anadyr River in Russia (Healey 1991). Additionally, chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970). Of the Pacific salmon, chinook salmon exhibit the most diverse and complex life history strategies. Healey (1986) described 16 age categories for chinook salmon, combinations of seven total ages with three possible freshwater ages. This level of complexity is roughly comparable to that seen in sockeye salmon (*O. nerka*), although the latter species has a more extended freshwater residence period and uses different freshwater habitats (Miller and Brannon 1982, Burgner 1991). Gilbert (1912) initially described two generalized freshwater life-history types: "stream-type" chinook salmon, which reside in freshwater for a year or more following emergence, and "ocean-type" chinook salmon, which migrate to the ocean within their first year. Healey (1983, 1991) has promoted the use of broader definitions for ocean-type and stream-type to describe two distinct races of chinook salmon. Healey's approach incorporates life-history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons of chinook salmon populations.

The generalized life history of Pacific salmon involves incubation, hatching, and emergence in freshwater; migration to the ocean; and the subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. The juvenile rearing period in freshwater can be minimal or extended. Additionally, some male chinook salmon mature in freshwater, thereby not emigrating to the ocean. The timing and duration of each of these stages is related to genetic and environmental determinants and their interactions to varying degrees. Although salmon exhibit a high degree of variability in life-history traits, there is considerable debate regarding the degree to which this variability is shaped by local adaptation or results from the general plasticity of the salmonid genome (Ricker 1972, Healey 1991, Taylor 1991). More detailed descriptions of the key features of chinook salmon life history can be found in Myers et al. (1998) and Healey (1991).

A.3.2 Steelhead

Steelhead can be divided into two basic run types based on the level of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner et al. 1992). The stream-maturing type, or summer steelhead, enters freshwater in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters freshwater with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variations in migration timing exist between populations. Some river basins have both summer and winter steelhead, whereas others only have one run type.

In the Pacific Northwest, summer steelhead enter freshwater between May and October (Busby et al. 1996, Nickelson et al. 1992). During summer and fall, before spawning, they hold in cool, deep pools (Nickelson et al. 1992). They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration to natal streams in early spring, and then spawn (Meehan and Bjornn 1991, Nickelson et al. 1992). Winter steelhead enter freshwater between November and April in the Pacific Northwest (Busby et al. 1996, Nickelson et al. 1992), migrate to spawning areas, and then spawn in late winter or spring. Some adults do not, however, enter coastal streams until spring, just before spawning (Meehan and Bjornn 1991). Difficult field conditions (snowmelt and high stream flows) and the remoteness of spawning grounds contribute to the relative lack of specific information on steelhead spawning.

Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females (Nickelson et al. 1992). Iteroparity is more common among southern steelhead populations than northern populations (Busby et al. 1996). Multiple spawnings for steelhead range from 3% to 20% of runs in Oregon coastal streams.

Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986, Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation. Cover, in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity (Giger 1973), is required to reduce disturbance and predation of spawning steelhead. Summer steelhead usually spawn further upstream than winter steelhead (Withler 1966, Behnke 1992).

Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months (August 9, 1996, 61 FR 41542) before hatching. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson et al. 1992).

Juveniles rear in freshwater from 1 to 4 years, then migrate to the ocean as smolts. Winter steelhead populations generally smolt after 2 years in freshwater (Busby et al. 1996). Steelhead typically reside in marine waters for 2 or 3 years before returning to their natal stream to spawn at 4 or 5 years of age. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remain dominant (Busby et al. 1996). Age structure appears to be similar to other west coast steelhead, dominated by 4-year-old spawners (Busby et al. 1996).

Based on purse seine catches, juvenile steelhead tend to migrate directly offshore during their first summer, rather than migrating along the coastal belt as do salmon. During fall and winter, juveniles move southward and eastward (Hartt and Dell 1986). Oregon steelhead tend to be north-migrating (Nicholas and Hankin 1988, Pearcy et al. 1990, Pearcy 1992).

A.3.3 Chum Salmon

Historically, chum salmon were distributed throughout the coastal regions of western Canada and the United States, as far south as Monterey Bay, California. Presently, major spawning populations are found only as far south as Tillamook Bay on the northern Oregon coast.

Chum salmon (*Oncorhynchus keta*) are semelparous, spawn primarily in freshwater, and, apparently, exhibit obligatory anadromy (there are no recorded landlocked or naturalized freshwater populations) (Randall et al. 1987). Chum salmon spend more of their life history in marine waters than other Pacific salmonids. Like pink salmon, chum salmon usually spawn in the lower reaches of rivers, with redds usually dug in the mainstem or in side channels of rivers from just above tidal influence to nearly 100 km from the sea. Juveniles outmigrate to seawater almost immediately after emerging from the gravel that covers their redds (Salo 1991). This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus *Oncorhynchus* (e.g., coastal cutthroat trout, steelhead, coho salmon, and most types of chinook and sockeye salmon), which usually migrate to sea at a larger size, after months or years of freshwater rearing. This means that survival and growth in juvenile chum salmon depend less on freshwater conditions (unlike stream-type salmonids which depend heavily on freshwater habitats) than on favorable estuarine conditions. Another behavioral difference between chum salmon and species that rear extensively in freshwater is that chum salmon form schools, presumably to reduce predation (Pitcher 1986), especially if their movements are synchronized to swamp predators (Miller and Brannon 1982).

A.3.4 Sockeye Salmon

Snake River sockeye salmon adults enter the Columbia River primarily during June and July. Arrival at Redfish Lake, which now supports the only remaining run of Snake River sockeye salmon, peaks in August, and spawning occurs primarily in October (Bjornn et al. 1968). Eggs hatch in the spring between 80 and 140 days after spawning. Fry remain in the gravel for 3 to 5 weeks, emerge from April through May, and move immediately into the lake. Once there, juveniles feed on plankton for 1 to 3 years before they migrate to the ocean (Bell 1986). Migrants leave Redfish Lake during late April through May (Bjornn et al. 1968) and travel almost 900 miles to the Pacific Ocean. Smolts reaching the ocean remain inshore or within the influence of the Columbia River plume during the early summer months. Later, they migrate through the northeast Pacific Ocean (Hart 1973, Hartt and Dell 1986). Snake River sockeye salmon usually spend 2 to 3 years in the Pacific Ocean and return in their fourth or fifth year of life. For detailed information on the Snake River sockeye salmon, see Waples et al. (1991a).

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A.4 POPULATION DYNAMICS AND DISTRIBUTION

The following sections provide specific information on the distribution and population structure (size, variability, and trends of the stocks or populations) of each listed ESU. Most of this information comes from observations made in terminal, freshwater areas, which may be distinct from the action area. This focus is appropriate because the species status and distribution can only be measured at this level of detail as adults return to spawn.

A.4.1 Chinook Salmon

A.4.1.1 Snake River Spring/Summer Chinook Salmon

The present range of spawning and rearing habitat for naturally spawned SR spring/summer chinook salmon is primarily limited to the Salmon, Grande Ronde, Imnaha, and Tucannon subbasins. Most SR spring/summer chinook salmon enter individual subbasins from May through September. Juvenile SR spring/summer chinook salmon emerge from spawning gravels from February through June (Peery and Bjornn 1991). Typically, after rearing in their nursery streams for about 1 year, smolts begin migrating seaward in April and May (Bugert et al. 1990, Cannamela 1992). After reaching the mouth of the Columbia River, spring/summer chinook salmon probably inhabit nearshore areas before beginning their northeast Pacific Ocean migration, which lasts 2 to 3 years. Because of their timing and ocean distribution, these stocks are subject to very little ocean harvest. For detailed information on the life history and stock status of SR spring/summer chinook salmon, see Matthews and Waples (1991a), NMFS (1991b), and 56 FR 29542 (June 27, 1991).

Bevan et al. (1994) estimated the number of wild adult SR spring/summer chinook salmon in the late 1800s to be more than 1.5 million fish annually. By the 1950s, the population had declined to an estimated 125,000 adults. Escapement estimates indicate that the population continued to decline through the 1970s. Returns varied through the 1980s, but have declined further in recent years. Record low returns were observed in 1994 and 1995. Dam counts were modestly higher from 1996 through 1998, but declined in 1999. For management purposes, the spring and summer chinook salmon in the Columbia River basin, including those returning to the Snake River, have been managed as separate stocks. Historical databases, therefore, provide separate estimates for the spring and summer chinook salmon components. Table A-3 reports the estimated annual return of adult, natural-origin SR spring and summer chinook salmon returning to Lower Granite Dam since 1979.

NMFS set an interim recovery level for SR spring/summer chinook salmon (31,400 adults at Ice Harbor Dam) in its proposed recovery plan (NMFS 1995). The SR spring/summer chinook salmon ESU consists of 39 local spawning populations (subpopulations) spread over a large geographic area (Lichatowich et al. 1993). The number of fish returning to Lower Granite Dam is, therefore, divided among these subpopulations. The relationships between these subpopulations, and particularly the degree to which individuals may intermix, are unknown. It

Table A-3. Estimates of natural-origin SR spring/summer chinook salmon counted at Lower Granite Dam in recent years (CRITFC 1999).

Year	Spring Chinook	Summer Chinook	Total
1979	2,573	2,712	5,285
1980	3,478	2,688	6,166
1981	7,941	3,326	11,267
1982	7,117	3,529	10,646
1983	6,181	3,233	9,414
1984	3,199	4,200	7,399
1985	5,245	3,196	8,441
1986	6,895	3,934	10,829
1987	7,883	2,414	10,297
1988	8,581	2,263	10,844
1989	3,029	2,350	5,379
1990	3,216	3,378	6,594
1991	2,206	2,814	5,020
1992	11,285	1,148	12,433
1993	6,008	3,959	9,967
1994	1,416	305	1,721
1995	745	371	1,116
1996	1,358	2,129	3,487
1997	1,434	6,458	7,892
1998	5,055	3,371	8,426
1999	1,433	1,843	3,276
		Recovery Esc Level	31,440

is unlikely that all 39 are independent populations per the definition in McElhany et al. (2000), which requires that each be isolated such that the exchange of individuals between populations does not substantially affect population dynamics or extinction risk over a 100-year time frame. Nonetheless, monitoring the status of subpopulations provides more detailed information on the status of the species than would an aggregate measure of abundance.

Seven of these subpopulations have been used as index stocks to analyze extinction risk and alternative actions that may be taken to meet survival and recovery requirements. The Snake River Salmon Recovery Team selected these subpopulations primarily because of the availability of a relatively long-term series of abundance data. The BRWG developed recovery and threshold abundance levels for the index stocks, which serve as reference points for comparisons with observed escapements (Table A-4). The threshold abundances represent levels at which uncertainties (and, thus, the likelihood of error) about processes or population enumeration are likely to be biologically significant and at which qualitative changes in processes are likely to occur. They were not developed as indicators of pseudo-extinction or as absolute indicators of critical thresholds. In any case, escapement estimates for the index stocks have generally been well below threshold levels in recent years (Table A-4).

Table A-4. Estimated number of natural-origin adult spawners plus recovery levels and BRWG threshold abundance levels for the seven SR spring/summer chinook salmon index stocks.

Brood year	Bear Valley	Marsh	Sulphur	Minam	Imnaha	Poverty Flats	Johnson
1979	215	83	90	40	238	76	66
1980	42	16	12	43	183	163	55
1981	151	115	43	50	453	187	102
1982	83	71	17	104	590	192	93
1983	171	60	49	103	435	337	152
1984	137	100	0	101	557	220	36
1985	295	196	62	625	641	341	178
1986	224	171	385	178	449	233	129
1987	456	268	67	342	401	554	175
1988	1109	395	607	306	504	765	332
1989	91	80	43	197	134	237	103
1990	185	101	170	146	84	518	141
1991	181	72	213	116	70	488	151
1992	173	114	21	10	73	524	180
1993	709	216	263	149	362	785	357
1994	33	9	0	16	52	189	50
1995	16	0	4	26	54	73	20
1996	56	18	23	213	143	127	49
1997	225	110	43	134	153	228	236
1998	372	164	140	118	90	348	119
1999	72	0	0	91	56	138	49
Recovery Level	**900**	**450**	**300**	**450**	**850**	**850**	**300**
BRWG Threshold	**300**	**150**	**150**	**150**	**300**	**300**	**150**

Spring chinook salmon index stocks: Bear Valley, Marsh, Sulphur, and Minam. Summer-run index stocks: Poverty Flats and Johnson. Run-timing for the Imnaha stocks is intermediate. Source: ODFW (2000)

As of June 1, 2000, the preliminary final aggregate count for upriver spring chinook salmon at Bonneville Dam was 178,000, substantially higher than the 2000 forecast of 134,000.[1] This is the second highest return in 30 years (after the 1972 return of 179,300 adults). Although only a small portion of these fish is expected to be natural-origin spring chinook salmon destined for the Snake River (5,800), the aggregate estimate for natural-origin SR spring chinook salmon is substantially higher than the contributing brood year escapements (comparable returns to the Columbia River mouth in 1995 and 1996 were 1,829 and 3,903, respectively). The 2000 forecast for the upriver summer chinook salmon stocks is 33,300, which is, again, the second highest return in over 30 years, but with only a small portion (2,000) being natural-origin fish destined for the Snake River. The return of natural-origin fish compares to brood year escapements in

[1] Source: June 1, 2000, e-mail from R. Bayley (NMFS) to Stephen H. Smith (NMFS). "Spring chinook update (end-of-season at Bonneville Dam)."

1995 and 1996 of 534 and 3,046 and is generally lower than the average returns over the last 5 years (3,466).

The probability of meeting survival and recovery objectives for SR spring/summer chinook salmon under various future operation scenarios for the hydrosystem was analyzed through a process referred to as PATH (Plan for Analyzing and Testing Hypotheses). The scenarios analyzed focused on status quo management and options that emphasized either juvenile transportation or hydro-project drawdown. PATH also included sensitivity analyses to alternative harvest rates and habitat effects. PATH estimated the probability of survival and recovery for the seven index stocks using the recovery and escapement threshold levels as abundance indicators. The forward simulations estimated the probability of meeting the survival thresholds after 24 and 100 years.

A 70% probability of exceeding the threshold escapement levels was used to assess survival. Recovery potential was assessed by comparing the projected abundance to the recovery abundance levels after 48 years. A 50% probability of exceeding the recovery abundance levels was used to evaluate recovery by comparing the 8-year mean projected abundance. In general, the survival and recovery standards were met for operational scenarios involving drawdown, but were not met under status quo management or for the scenarios that relied on juvenile transportation (Marmorek et al. 1998). If the most conservative harvest rate schedule was assumed, transportation scenarios came very close to meeting the survival and recovery standards.

For the SR spring/summer chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[2] ranges from 0.96 to 0.80, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to the effectiveness of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000b). NMFS has also estimated median population growth rates and the risk of absolute extinction for the seven spring/summer chinook salmon index stocks,[3] using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years for the wild component ranges from zero for Johnson Creek to 0.78 for the Imnaha River (Table B-5 in McClure et al. 2000b). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years ranges from zero for Johnson Creek to 1.00 for the wild component in the Imnaha River (Table B-6 in McClure et al. 2000b).

A.4.1.2 Snake River Fall Chinook Salmon

The spawning grounds between Huntington (RM 328) and Auger Falls (RM 607) were historically the most important for this species. Only limited spawning activity was reported

[2] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1999 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

[3] McClure et al. (2000c) have calculated population trend parameters for additional SR spring/summer chinook salmon stocks.

downstream from RM 273 (Waples et al. 1991a), about 1 mile upstream of Oxbow Dam. Since then, irrigation and hydrosystem projects on the mainstem Snake River have blocked access to or inundated much of this habitat—causing the fish to seek out less preferable spawning grounds wherever they are available. Natural fall chinook salmon spawning now occurs primarily in the Snake River below Hells Canyon Dam and the lower reaches of the Clearwater, Grand Ronde, Salmon, and Tucannon rivers.

Adult SR fall chinook salmon enter the Columbia River in July and migrate into the Snake River from August through October. Fall chinook salmon generally spawn from October through November, and fry emerge from March through April. Downstream migration generally begins within several weeks of emergence (Becker 1970, Allen and Meekin 1973), and juveniles rear in backwaters and shallow water areas through mid-summer before smolting and migrating to the ocean—thus they exhibit an ocean-type juvenile history. Once in the ocean, they spend 1 to 4 years (though usually, 3 years) before beginning their spawning migration. Fall returns in the Snake River system are typically dominated by 4-year-old fish. For detailed information on SR fall chinook salmon, see NMFS (1991a) and June 27, 1991, 56 FR 29542.

No reliable estimates of historical abundance are available. Because of their dependence on mainstem habitat for spawning, however, fall chinook salmon probably have been affected by the development of irrigation and hydroelectric projects to a greater extent than any other species of salmon. It has been estimated that the mean number of adult SR fall chinook salmon declined from 72,000 in the 1930s and 1940s to 29,000 during the 1950s. Despite this decline, the Snake River remained the most important natural production area for fall chinook salmon in the entire Columbia River basin through the 1950s. The number of adults counted at the uppermost Snake River mainstem dams averaged 12,720 total spawners from 1964 to 1968, 3,416 spawners from 1969 to 1974, and 610 spawners from 1975 to 1980 (Waples et al. 1991b).

Counts of natural-origin adult fish continued to decline through the 1980s, reaching a low of 78 individuals in 1990 (Table A-5). Since then, the return of natural-origin fish to Lower Granite Dam has varied, but has generally increased, reaching a recent year high of 797 in 1997. The 1998 return declined to 306. This was not anticipated and is of particular concern because it is close to the low threshold escapement level of 300 that indicates increased risk (BRWG 1994). The low return in 1998 may have been due to severe flooding in 1995 that affected the primary contributing brood year. The expected return of natural-origin adults to Lower Granite Dam in 1999 given the anticipated ocean and inriver fisheries is 518.

The recovery standard identified in the 1995 Proposed Recovery Plan (NMFS 1995) for SR fall chinook salmon was a population of at least 2,500 naturally produced spawners (to be calculated as an 8-year geometric mean) in the lower Snake River and its tributaries. Before the adult counts at Lower Granite Dam can be compared to the natural spawner escapement, adults that may fall back below the dam after counting must be accounted for, as well as prespawning mortality. A preliminary estimate suggested that a Lower Granite Dam count of 4,300 would be necessary to meet the 2,500-fish escapement goal (NMFS 1995). For comparison, the geometric mean of the Lower Granite Dam counts of natural-origin fall chinook salmon over the last 8 years is 481.

A further consideration regarding the status of SR fall chinook salmon is the existence of the Lyons Ferry Hatchery stock which is considered part of the ESU. Several hundred adults have returned to the Lyons Ferry Hatchery in recent years (Table A-5). More recently, supplementation efforts designed to accelerate rebuilding were initiated, beginning with smolt outplants from the 1995 brood year. The existence of the Lyons Ferry program has been an important consideration in evaluating the status of the ESU, because it reduces the short-term risk of extinction by providing a reserve of fish from the ESU. Without the hatchery program, the risk of extinction would have to be considered high because the ESU would otherwise be comprised of a few hundred individuals from a single population, in marginal habitat, with a demonstrated record of low productivity. Although the supplementation program probably contributes to the future population of natural-origin spawners, it does little to change the productivity of the system upon which a naturally spawning population must rely. Supplementation is, therefore, not a long-term substitute for recovery. [See NMFS 1999b for further discussion of the SR fall chinook salmon supplementation program.]

Recent analyses conducted through the PATH process considered the prospects for survival and recovery given several future management options for the hydrosystem and other mortality sectors (Marmorek et al. 1998, Peters et al. 1999). That analysis indicated that the prospects of survival for SR fall chinook salmon were good, but that full recovery was relatively unlikely except under a very limited range of assumptions, or unless drawdown was implemented for at least the four lower Snake River dams operated by the U.S. Army Corps of Engineers (Corps). Consideration of the drawdown options led to a high likelihood that both survival and recovery objectives could be achieved.

For the SR fall chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[4] ranges from 0.94 to 0.86, decreasing as the

[4] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1996 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

Table A-5. Escapement and stock composition of fall chinook salmon at Lower Granite (LGR) Dam[1].

				Stock Comp. of Escapement to LGR		
					Hatchery Origin	
Year	LGR Dam Count	Marked Fish to Lyons Ferry Hatch.	LGR Dam Escapement	Wild	Snake R.	Non-Snake R.
1975	1,000		1,000	1,000		
1976	470		470	470		
1977	600		600	600		
1978	640		640	640		
1979	500		500	500		
1980	450		450	450		
1981	340		340	340		
1982	720		720	720		
1983	540		540	428	112	
1984	640		640	324	310	6
1985	691		691	438	241	12
1986	784		784	449	325	10
1987	951		951	253	644	54
1988	627		627	368	201	58
1989	706		706	295	206	205
1990	385	50	335	78	174	83
1991	630	40	590	318	202	70
1992	855	187	668	549	100	19
1993	1,170	218	952	742	43	167
1994	791	185	606	406	20	180
1995	1,067	430	637	350	1	286
1996	1,308	389	919	639	74	206
1997	1,451	444	1,007	797	20	190
1998	1,909	947	962	306	479	177
1999[2]	3,381	1,519	1,862	905	882	75

[1] Information taken from *Revised Tables for the Biological Assessment of Impacts of Anticipated 1996-1998 Fall Season Columbia River Mainstem and Tributary Fisheries on SR Salmon Species Listed Under the Endangered Species Act*, prepared by the U.S. v. Oregon Technical Advisory Committee.
[2] Source: Memorandum from Glen Mendel (WDFW) to Cindy LeFluer (WDFW), dated March 3, 2000. "Fall chinook run reconstruction at LGR for 1999."

effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000b). NMFS has also estimated the risk of absolute extinction for the aggregate SR fall chinook salmon population, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.40 (Table B-5 in McClure et al. 2000b). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is 1.00 (Table B-6 in McClure et al. 2000b).

A.4.1.3 Upper Columbia River Spring-Run Chinook Salmon

The UCR spring-run chinook salmon ESU inhabits tributaries upstream from the Yakima River to Chief Joseph Dam. UCR spring-run chinook salmon have a stream-type life history. Adults return to the Wenatchee River from late March through early May, and to the Entiat and Methow rivers from late March through June. Most adults return after spending 2 years in the ocean, although 20% to 40% return after 3 years at sea. Like SR spring/summer chinook salmon, UCR spring-run chinook salmon experience very little ocean harvest. Peak spawning for all three populations occurs from August to September. Smolts typically spend 1 year in freshwater before migrating downstream. There are slight genetic differences between this ESU and others containing stream-type fish, but more importantly, the ESU boundary was defined using ecological differences in spawning and rearing habitat (Myers et al. 1998). The Grand Coulee Fish Maintenance Project (1939 through 1943) may have had a major influence on this ESU because fish from multiple populations were mixed into one relatively homogenous group and redistributed into streams throughout the upper Columbia region.

Three independent populations of spring-run chinook salmon are identified for the ESU including those that spawn in the Wenatchee, Entiat, and Methow basins (Ford et al. 1999). The number of natural-origin fish returning to each subbasin is shown in Table A-6. NMFS recently proposed interim recovery abundance levels and cautionary levels (i.e., interim levels still under review and subject to change). Ford et al. (1999) characterize cautionary levels as abundance levels that the population fell below only about 10% of the time during a historical period when it was considered to be relatively healthy. Escapements for UCR spring-run chinook salmon have been substantially below the cautionary levels in recent years, especially during 1995, indicating increasing risk to and uncertainty about the population's future status. On the other hand, preliminary returns for 1999, the primary return year for the 1995 brood, indicate that although they were low, returns were still substantially higher than the estimated cohort replacement level. Very strong 1999 jack returns suggest that survival rates for the 1996 brood will be high, as well. A total of 4,500 natural-origin UCR spring-run chinook salmon is expected to return to the mouth of the Columbia River during 2000 with a corresponding number expected to return to each subbasin (accounting for expected harvest, inter-dam loss, and prespawning mortality) at approximately its respective cautionary level (Table A-6).

Table A-6. Estimates of the number of natural-origin fish returning to subbasins for each independent population of UCR spring-run chinook salmon and preliminary interim recovery abundance and cautionary levels.

Year	Wenatchee River[1]	Entiat River	Methow River
1979	1,154	241	554
1980	1,752	337	443
1981	1,740	302	408
1982	1,984	343	453
1983	3,610	296	747
1984	2,550	205	890
1985	4,939	297	1,035
1986	2,908	256	778
1987	2,003	120	1,497
1988	1,832	156	1,455
1989	1,503	54	1,217
1990	1,043	223	1,194
1991	604	62	586
1992	1,206	88	1,719
1993	1,127	265	1,496
1994	308	74	331
1995	50	6	33
1996	201	28	126
1997	422	69	247
1998	218	52	125
1999	119	64	73
Recovery Abundance	**3,750**	**500**	**2,000**
Cautionary Abundance	**1,200**	**150**	**750**

Source: Cooney (2000)
[1] Estimates for the Wenatchee River exclude Icicle Creek/Leavenworth NFH.

Six hatchery populations are included in the listed ESU; all six are considered essential for recovery. Recent artificial production programs for fishery enhancement and hydrosystem mitigation have been a concern because a non-native (Carson Hatchery) stock was used. However, programs have been initiated to develop locally adapted brood stocks to supplement natural populations. Facilities where problems with straying and interactions with natural stock are known to occur are phasing out use of Carson stock. Captive broodstock conservation programs are under way in Nason Creek and White River (the Wenatchee basin) and in the Twisp River (Methow basin) to prevent the extinction of those spawning populations. All spring chinook salmon passing Wells Dam in 1996 and 1998 were trapped and brought into the hatchery to begin a composite-stock broodstock supplementation program for the Methow basin.

For the UCR spring chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[5] ranges from 0.85 to 0.83, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000b). NMFS has also estimated median population growth rates and the risk of absolute extinction for the three spawning populations identified by Ford et al. (1999), using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from 0.97 for the Methow River to 1.00 for the Wenatchee and Entiat rivers (Table B-5 in McClure et al. 2000b). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of extinction within 100 years is 1.00 for all three spawning populations (Table B-6 in McClure et al. 2000b).

NMFS has also used population risk assessments for UCR spring chinook salmon and steelhead ESUs from the draft quantitative analysis report (QAR; Cooney 2000). Risk assessments described in that report were based on Monte Carlo simulations with simple spawner/spawner models that incorporate estimated smolt carrying capacity. Population dynamics were simulated for three separate spawning populations in the UCR spring chinook salmon ESU, the Wenatchee, Entiat, and Methow populations. The QAR assessments showed extinction risks for UCR spring chinook salmon of 50% for the Methow, 98% for the Wenatchee, and 99% for the Entiat spawning populations. These estimates are based on the assumption that the median return rate for the 1980 brood year to the 1994 brood year series will continue into the future.

A.4.1.4 Upper Willamette River Chinook Salmon

UWR chinook salmon are one of the most distinct groups in the Columbia basin — genetically, in terms of age structure, and in terms of their marine distribution (64 FR 14322). The narrow time window available for passage above Willamette Falls (at Willamette RKm 42) may have limited migratory access to the upper basin to spring periods of high flow (Howell et al. 1985), providing reproductive isolation and, thereby, defining the boundary of a distinct biogeographic region. Winter steelhead and spring chinook salmon were indigenous above the falls, but

[5] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1998 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

summer steelhead, fall chinook salmon, and coho salmon were not (Busby et al. 1996). Because the Willamette Valley was not glaciated during the last epoch (McPhail and Lindsey 1970), any reproductive isolation provided by the falls would have been uninterrupted for a considerable time, providing the potential for significant local adaptation relative to other Columbia basin populations.

The life history of chinook salmon in the Upper Willamette River ESU includes traits from both ocean- and stream-type development strategies: smolts emigrate both as young-of-the-year and as age-1 fish. Mattson (1962) reported three distinct migrations of juvenile spring chinook salmon in the lower Willamette River (Lake Oswego area), including movements of a given year class during late winter through spring (age-0 migrants; 40 to 100 mm), late fall-early winter (age-1 fish; 100 to 130 mm), and then during the following spring (age-2 fish; 100 to 140 mm). Smolt and fry migration patterns at Leaburg Dam in the McKenzie River appear to have shifted over the years; samples collected between 1948 and 1968 indicated that fry emigrated primarily during March through June (Howell et al. 1988) but now peak during January through April (earlier than in previous years) (Corps 2000). Distribution in the ocean is consistent with an ocean-type life history (most are caught off the coasts of British Columbia and Southeast Alaska).

Historically, five major basins produced spring chinook salmon: the Clackamas, North and South Santiam, McKenzie, and Middle Fork Willamette rivers. However, between 1952 and 1968, dams were built on all of the major tributaries occupied by spring chinook salmon, blocking over half of the most productive spawning and rearing habitat. Water management operations have also reduced habitat quality in downstream areas due to thermal effects (relatively warm water released during autumn leads to the early emergence of stream-type chinook salmon fry, and cold water released during spring reduces juvenile growth rates).

Spring chinook salmon on the Clackamas River were unable to reach the upper watershed after 1917, when the fish ladder washed out at Faraday Dam, but recolonized the system after 1939, when the ladder was repaired. NMFS has not been able to determine whether the recolonization of the Clackamas system was human-mediated. Regardless, NMFS included natural-origin spring chinook salmon from the Clackamas subbasin as part of the listed ESU and considers this spawning population a potentially important genetic resource for recovery.

Information ODFW (1998c) provided indicates that, at present, the only significant natural production of spring chinook salmon above Willamette Falls occurs in the McKenzie River basin. Nicholas (1995) also suggested that a self-sustaining population exists in the North Santiam River basin (BRT 1998), but ODFW contends that the thermal profile of water released from Detroit Dam significantly reduces the survival of any progeny from naturally spawning fish (64 FR 14308). The McKenzie River may now account for 50% of the production potential in the Willamette River basin, with 80% of that above Leaburg Dam. The number of natural-origin fish counted at Leaburg Dam increased from 786 in 1994 to 1,364 in 1998 (Table A-7).

The Clackamas River currently accounts for about 20% of the production potential in the Willamette River basin, originating from one hatchery plus natural production areas that are primarily located above the North Fork Dam. The interim escapement goal for the area above North Fork Dam is 2,900 fish (ODFW 1998b). However, the system is so heavily influenced by hatchery production that it is difficult to distinguish spawners of natural stock from hatchery origin fish. Approximately 1,000 to 1,500 adults have been counted at the North Fork Dam in recent years.

More than 70% of the production capacity of the North Santiam system was blocked when Detroit Dam was built without passage facilities. The remaining downstream habitat is adversely affected by the temperature effects (i.e., warm water) of flow regulation. This system has also been substantially influenced by hatchery production, although the original genetic resource has been maintained as the Marion Forks Hatchery stock (ODFW 1998b). Despite these limitations, natural spawning continues in the lower river. The count of 194 redds in the area below Minto Dam (the lowest dam) during 1998 was marginally higher than during either of the preceding 2 years (Lindsay et al. 1998). The origin of these spawning adults has not been determined (although some coded-wire-tagged fish from Santiam River hatcheries have been recovered), nor has their reproductive success.

Mitigation hatcheries were built to offset the substantial habitat losses that resulted from dam construction. As a result, 85% to 95% of the production in the basin is now of hatchery origin. Although the hatchery programs have maintained broodlines that are relatively free of genetic influences from outside the basin, they may have homogenized within-basin stocks, reducing the population structure within the ESU. Prolonged artificial propagation of most of the production from this ESU may also have reduced the ability of Willamette River spring chinook salmon to reproduce successfully in the wild. Five of six existing hatchery stocks were included in the ESU, but none was listed or considered essential for recovery.

The spring run has been counted at Willamette Falls since 1946, but jacks were not differentiated from the total count until 1952. The geometric mean of the estimated run size from 1946 through 1950 was 43,300 fish, compared to an estimate for the most recent 5 years (1994 through 1998) of 25,500 (Table 22 in ODFW and WDFW 1999 and Table A-7). Nicholas (1995) estimated only 3,900 natural spawners in 1994 for the ESU, approximately 1,300 of these naturally produced. The number of naturally spawning fish has increased gradually in recent years, but NMFS believes that many are first-generation hatchery fish.

Table A-7. Run size of spring chinook salmon at the mouth of the Willamette River and counts at Willamette Falls and Leaburg Dam on the McKenzie River.

Return Year	Estimated Number Entering Willamette River	Willamette Falls Count	Leaburg Dam Count	
			Combined	Wild Only
1985	57,100	34,533	825	
1986	62,500	39,155	2,061	
1987	82,900	54,832	3,455	
1988	103,900	70,451	6,753	
1989	102,000	69,180	3,976	
1990	106,300	71,273	7,115	
1991	95,200	52,516	4,359	
1992	68,000	42,004	3,816	
1993	63,900	31,966	3,617	
1994	47,200	26,102	1,526	786
1995	42,600	20,592	1,622	894
1996	34,600	21,605	1,445	1,086
1997	35,000	26,885	1,176	981
1998	45,100	34,461	1,874	1,364
1999	58,000	40,410	1,458	1,416
2000		37,594		

Sources: Nicholas (1995) and ODFW and WDFW (1998); Willamette Falls count for 2000 from ODFW (2000). The Leaburg counts show wild and hatchery counts combined since 1985 and wild counts only since 1994. Estimates for 1999 are preliminary.

For the UWR chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[6] ranges from 1.01 to 0.63, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000b). NMFS has also estimated the risk of absolute extinction for the aggregate UWR chinook salmon population in the McKenzie River, above Leaburg, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.01 (Table B-5 in McClure et al. 2000b). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is 0.85 (Table B-6 in McClure et al. 2000b).

[6] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1998 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

A.4.1.5 Lower Columbia River Chinook Salmon

The LCR chinook salmon ESU includes spring stocks as well as fall tule and bright components. Spring-run chinook salmon on the lower Columbia River, like those from coastal stocks, enter freshwater in March and April, well in advance of spawning in August and September. Historically, the spring migration was synchronized with periods of high rainfall or snowmelt to provide access to upper reaches of most tributaries, where spring stocks would hold until spawning (Fulton 1968, Olsen et al. 1992, WDF et al. 1993b).

Fall chinook salmon predominate in the lower Columbia River salmon runs. Tule-type fall chinook salmon return to the river in mid-August and spawn within a few weeks (WDF et al. 1993b, Kostow 1995). Most fall-run chinook salmon emigrate to the marine environment as subyearlings (Reimers and Loeffel 1967, Howell et al. 1985, WDF et al. 1993b). Returning adults that emigrated as yearling smolts may have originated from the extensive hatchery programs within the ESU. It is also possible that modifications in the river environment have altered the duration of freshwater residence. Adult fall-run tule chinook salmon return to tributaries in the lower Columbia River at 3 and 4 years of age compared to 4 to 5 years for bright chinook salmon and spring-run fish. Marine coded-wire-tag recoveries for LCR stocks tend to occur off the British Columbia and Washington coasts, although a small proportion of the tags are recovered in Alaskan waters.

There are no reliable estimates of historical abundance for this ESU as early as the beginning of the last century, but it is generally agreed that natural production has been greatly reduced. Recent abundance estimates include a 5-year (1991 through 1995) geometric mean natural spawning escapement of 29,000 natural spawners and 37,000 hatchery spawners. However, according to the accounting of PFMC (1996), approximately 68% of the natural spawners are first-generation hatchery strays.

Hatchery programs to enhance chinook salmon fisheries in the lower Columbia River began in the 1870s, expanded rapidly, and have continued throughout this century. Although most hatchery stocks have come from within this ESU, more than 200 million fish from outside the ESU have been released since 1930. A particular concern noted at the time of listing related to straying by Rogue River fall-run chinook salmon, which are released into the lower Columbia River to augment harvest. The release strategy has since been modified to minimize straying, but it is too early to assess the effect of the change. Available evidence indicates a pervasive influence of hatchery fish on most natural populations of LCR chinook salmon, including both spring- and fall-run populations (Howell et al. 1985, Marshall et al. 1995). In addition, the exchange of eggs between hatcheries in this ESU has led to the extensive genetic homogenization of hatchery stocks (Utter et al. 1989).

The remaining spring-run chinook salmon stocks in the LCR chinook salmon ESU are found in the Sandy River, Oregon, and the Lewis, Cowlitz, and Kalama rivers, Washington. Spring chinook salmon in the Clackamas River are considered part of the UWR chinook salmon ESU. Despite the substantial influence of fish from hatcheries in the Upper Willamette River ESU in past years, naturally spawning spring chinook salmon in the Sandy River are included in the LCR chinook salmon ESU because they probably contain the remainder of the original genetic legacy for that system. Recent escapements above Marmot Dam on the Sandy River average

2,800 and have been increasing (ODFW 1998a). Hatchery-origin spring chinook salmon are no longer released above Marmot Dam; the proportion of first generation hatchery fish in the escapement is relatively low, on the order of 10% to 20% in recent years. In 1999, the escapement dropped to 1,828 fish, in part because only unmarked naturally produced fish were passed over Marmot Dam (Schroeder et al. 1999).

On the Washington side, spring chinook salmon were native to the Cowlitz and Lewis rivers and there is anecdotal evidence that a distinct spring run existed in the Kalama River subbasin (WDF 1951). The Lewis River spring run was severely affected by dam construction. During the period between the construction of Merwin Dam in 1932 and Yale Dam in the early 1950s, WDF attempted to maintain the run by collecting adults at Ariel/Merwin for hatchery propagation or (in years when returns were in excess of hatchery needs) release to the spawning grounds (WDF 1951). As native runs dwindled, Cowlitz spring-run chinook salmon were reintroduced in an effort to maintain them. In the Kalama River, escapements of less than 100 fish were present until the early 1960s when spring-run hatchery production was initiated with a number of stocks from outside the basin. Recent (1994 through 1998) average estimates for naturally spawning spring chinook salmon are 235, 224, and 372 fish in the Cowlitz, Kalama, and Lewis rivers, respectively. Some (perhaps a large) proportion of the natural spawners in each system is believed to be composed of hatchery strays (ODFW 1998a). Although, the Lewis and Kalama hatchery stocks have been mixed with out-of-basin stocks, they are included in the ESU. The Cowlitz River hatchery stock is largely free of introductions. Although it is considered essential for recovery, it is not listed because the state of Washington's hatchery and harvest practices are considered sufficiently protective of this stock to ensure that their future existence and value for recovery are not at risk (64 FR 14321). Spring chinook salmon returning to the Cowlitz, Kalama, and Lewis rivers have declined in recent years, but they still number several hundred to a few thousand in each system (Table A-8).

Apparently, three self-sustaining natural populations of tule chinook salmon that are not substantially influenced by hatchery strays occur in the lower Columbia River (Coweeman, East Fork Lewis, and Clackamas). Returns to the East Fork and Coweeman have been stable and near interim escapement goals in recent years. Recent 5- and 10-year average escapements to the East Fork Lewis River met the interim escapement goal of 300. Recent 5- and 10-year average escapements to the Coweeman River are 900 and 700, respectively, compared to an interim natural escapement goal of 1,000 (pers. comm., from G. Norman, WDFW to P. Dygert NMFS, February 22, 1999). Natural escapement on the Clackamas has averaged about 350 in recent years. There have been no releases of hatchery fall chinook salmon in the Clackamas since 1981, and there are apparently few hatchery strays. The population is considered depressed, but stable and self-sustaining (ODFW 1998a). There is some natural spawning of tule fall chinook salmon in the Wind and Little White Salmon rivers, tributaries above Bonneville Dam (the only component of the ESU that is affected by Tribal fisheries). Although there may be some natural production in these systems, the spawners are primarily hatchery-origin strays.

LCR bright fall chinook salmon escapement to the North Fork Lewis River exceeded the escapement goal of 5,700 by a substantial margin every year from the 1970s until 1978. However, runs have been declining and, probably combined with the effect of the 1996 and 1997 floods on habitat, the 1999 return was low (about 2,300). A return of 2,700 is forecast for 2000 (PFMC 2000).

There are two smaller populations of LCR bright fall chinook salmon in the Sandy and East Fork Lewis rivers. Run sizes in the Sandy River have averaged about 1,000 and have been stable for the last 10 to 12 years. The fall chinook salmon hatchery program in the Sandy River was discontinued in 1977, with the intention of reducing the number of hatchery strays in the system. There is also a late spawning component in the East Fork Lewis River that is comparable in timing to the other bright stocks. The escapement of these fish is not as well documented, but it appears to be stable and largely unaffected by hatchery fish (ODFW 1998b).

All basins in the region are affected by habitat degradation to varying degrees. Major habitat problems are related primarily to blockages, forest practices, urbanization in the Portland and Vancouver areas, and agriculture in floodplains and low-gradient tributaries. Substantial chinook salmon spawning habitat has been blocked (or passage has been substantially impaired) in the Cowlitz (Mayfield Dam 1963, Rkm 84), Lewis (Merwin Dam 1931, Rkm 31), Clackamas (North Fork Dam 1958, Rkm 50), Hood (Powerdale Dam 1929, Rkm 7), and Sandy (Marmot Dam 1912, Rkm 48; Bull Run River dams in the early 1900s) rivers (WDF et al. 1993b, Kostow 1995).

For the LCR chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[7] ranges from 0.98 to 0.88, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000b). NMFS estimated the risk of absolute extinction for nine spawning aggregations,[8] using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from zero for the Sandy River late run and Big Creek to 1.00 for Mill Creek (Table B-5 in McClure et al. 2000b). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is ≥0.99 for all but one of the nine spawning aggregations (zero for the Sandy River late run; Table B-6 in McClure et al. 2000b).

Table A-8. Estimated returns of adult LCR spring-run chinook salmon to tributaries, 1992 through 1999.

Year	Sandy River	Cowlitz River	Lewis River	Kalama River	Total Returns (Excluding Willamette)
1992	8,600	10,400	5,600	2,400	27,200
1993	6,400	9,500	6,600	3,000	25,500

[7] Estimates of median population growth rate, risk of extinction, and likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1997 adult returns for most spawning aggregations. Population trends are projected under the assumption that all conditions will stay the same into the future.

[8] McClure et al. (2000c) have calculated population trend parameters for additional LCR chinook salmon stocks.

1994	3,500	3,100	3,000	1,300	10,900
1995	2,500	2,200	3,700	700	9,100
1996	4,100	1,800	1,700	600	8,200
1997	5,200	1,900	2,200	600	9,900
1998	4,300	1,100	1,600	400	7,400
1999		1,600	1,900	600	

Source: Pettit 1998, ODFW and WDFW 1999

A.4.2 Steelhead

A.4.2.1 Snake River Steelhead

The longest consistent indicator of steelhead abundance in the Snake River basin is derived from counts of natural-origin steelhead at the uppermost dam on the lower Snake River. According to these estimates, the abundance of natural-origin summer steelhead at the uppermost dam on the Snake River has declined from a 4-year average of 58,300 in 1964 to a 4-year average of 8,300 ending in 1998. In general, steelhead abundance declined sharply in the early 1970s, rebuilt modestly from the mid-1970s through the 1980s, and declined again during the 1990s (Figure A-1).

These broad-scale trends in the abundance of steelhead were reviewed through the PATH process. The PATH report indicated that the initial, substantial decline coincided with the declining trend in downstream passage survival through the Federal hydrosystem. The more recent decline in abundance, observed over the last decade or more, does not coincide with declining passage survival, but can be at least partially be accounted for by a shift in climatic regimes that has affected ocean survival (Marmorek 1998).

The abundance of A-run versus B-run components of Snake River basin steelhead can be distinguished in data collected since 1985. Both components have declined through the 1990s, but the decline of B-run steelhead has been more significant. The 4-year average counts at Lower Granite Dam declined from 18,700 to 7,400 beginning in 1985 for A-run steelhead and from 5,100 to 900 for B-run steelhead. Counts over the last 5 or 6 years have been stable for A-run steelhead and without apparent trend (Figure A-2). Counts for B-run steelhead have been low and highly variable, but also without apparent trend (Figure A-3).

Comparison of recent dam counts with escapement objectives provides perspective regarding the status of the ESU. The management objective for SR steelhead stated in the Columbia River Fisheries Management Plan was to return 30,000 natural/wild steelhead to Lower Granite Dam. The All Species Review (TAC 1997) further clarified that this objective was subdivided into 20,000 A-run and 10,000 B-run steelhead. Idaho has reevaluated these escapement objectives using estimates of juvenile production capacity. This alternative methodology led to revised estimates of 22,000 for A-run and 31,400 for B-run steelhead (pers. comm., S. Keifer, IDFG. with P. Dygert, NMFS).

The state of Idaho has conducted redd count surveys in all of the major subbasins since 1990. Although the surveys are not intended to quantify adult escapement, they can be used as indicators of relative trends. The sum of redd counts in natural-origin B-run production subbasins declined from 467 in 1990 to 59 in 1998 (Figure A-4). The declines are evident in all four of the primary B-run production areas. Index counts in the natural-origin A-run production areas have not been conducted with enough consistency to permit similar characterization.

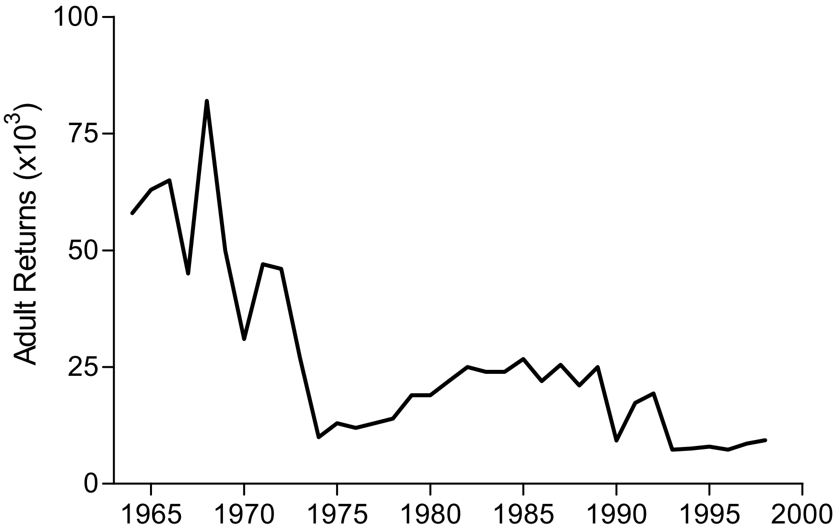
Idaho has also conducted surveys for juvenile abundance in index areas throughout the Snake River basin since 1985. Parr densities of A-run steelhead have declined from an average of about 75% of carrying capacity in 1985 to an average of about 35% in recent years through 1995 (Figure A-5). Further declines were observed in 1996 and 1997. Parr densities of B-run steelhead have been low, but relatively stable since 1985, averaging 10% to 15% of carrying capacity through 1995. Parr densities in B-run tributaries declined further in 1996 and 1997 to 11% and 8%, respectively.

The available data indicate that B-run steelhead are much more depressed than A-run steelhead. In evaluating the status of the SR basin steelhead ESU it is pertinent to consider whether B-run steelhead represent a significant portion of the ESU. This is particularly relevant for two reasons:

1) The Tribes have proposed to manage the SR basin steelhead ESU as a whole without distinguishing between components

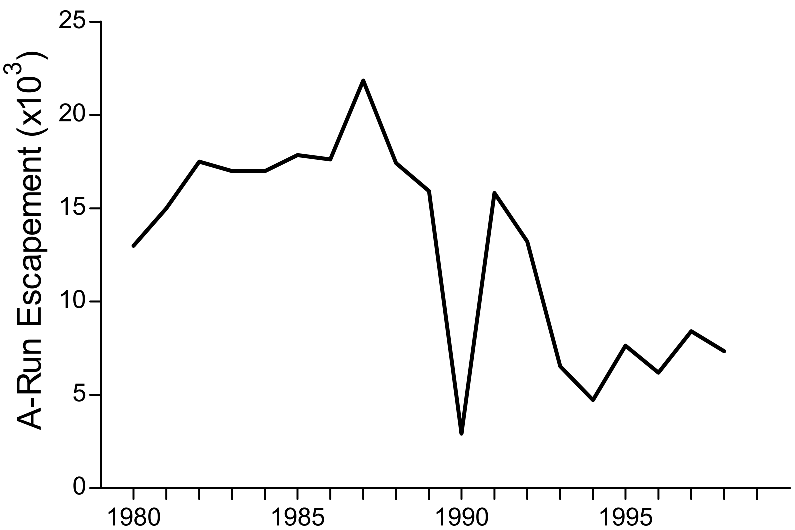
2) This management scenario is inconsistent with NMFS’ authority to manage for components of an ESU.

Figure A-1. Adult returns of wild summer steelhead to the uppermost dam on the Snake River.



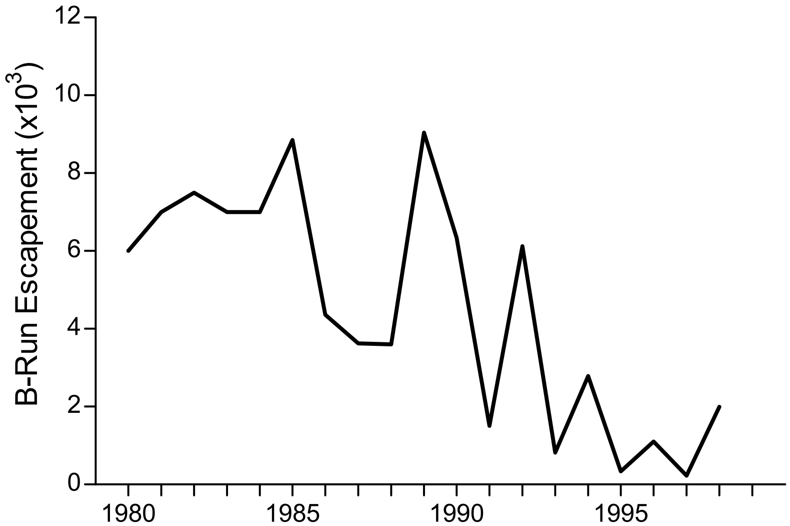
Source: Escapement through 1995 from TAC (1997); escapement for 1996–1998 from pers. comm. G. Mauser (IDFG).

Figure A-2. Escapement of A-run Snake River steelhead to the uppermost dam.



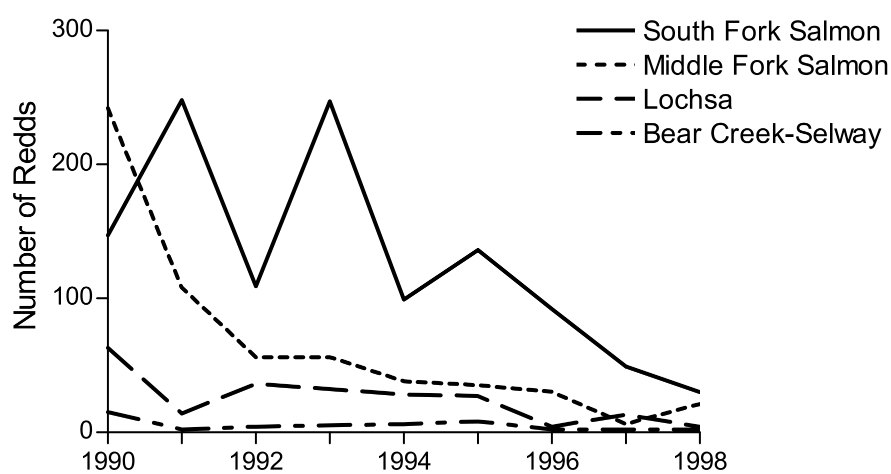
Source: Data for 1980 through 1984 from Figures 1 and 2 of Section 8 in TAC (1997). Data for 1985 through 1998 from Table 2 of Section 8 (TAC 1997) and pers. comm. G. Mauser, IDFG.

Figure A-3. Escapement of B-run Snake River steelhead to the uppermost dam.



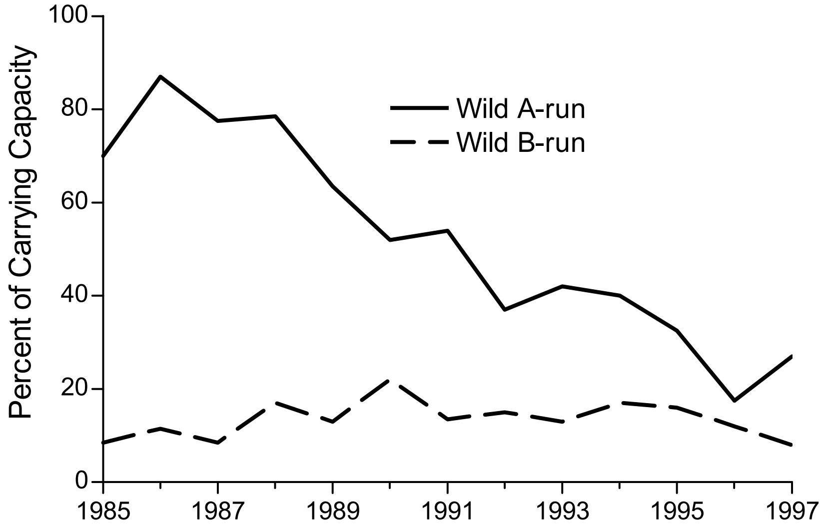
Source: Data for 1980 through 1984 from Figures 1 and 2 of Section 8 in TAC (1997). Data for 1985 through 1998 from Table 2 of Section 8 (TAC 1997) and pers. comm. G. Mauser, IDFG.

Figure A-4. Redd counts for wild Snake River (B-run) steelhead in the South Fork and Middle Fork Salmon, Lochsa, and Bear Creek-Selway index areas.



Note: Data for the Lochsa exclude Fish Creek and Crooked Fork.
Sources: Memo from T. Holubetz (IDFG), "1997 Steelhead Redd Counts," dated May 16, 1997, and IDFG (unpubl. data).

Figure A-5. Percent of estimated carrying capacity for juvenile (age-1+ and -2+) wild A- and B-run steelhead in Idaho streams.



Source: Data for 1985 through 1996 from Hall-Griswold and Petrosky (1998); data for 1997 from IDFG (unpublished).

The Snake River historically supported more than 55% of total natural-origin production of steelhead in the Columbia basin. It now has approximately 63% of the basin's natural production potential (Mealy 1997). B-run steelhead occupy four major subbasins, including two on the Clearwater River (Lochsa and Selway) and two on the Salmon River (Middle Fork and South Fork Salmon), areas that are for the most part not occupied by A-run steelhead. Some natural B-run steelhead are also produced in parts of the mainstem Clearwater and its major tributaries. There are alternative escapement objectives of 10,000 Columbia River Fisheries Management Plan and 31,400 (Idaho) for B-run steelhead. B-run steelhead, therefore, represent at least 1/3 and as much as 3/5 of the production capacity of the ESU.

B-run steelhead are distinguished from the A-run component by their unique life history characteristics. B-run steelhead were traditionally distinguished as larger and older fish with a later run timing, returning primarily to the South Fork Salmon, Middle Fork Salmon, Selway, and Lochsa rivers. The recent review by Technical Advisory Committee indicated that different populations of steelhead do have different size structures, with populations dominated by larger fish (i.e., greater than 77.5 cm) occurring in the traditionally defined B-run basins (TAC 1999). Larger fish occur in other populations throughout the basin, but at much lower rates. Evidence suggests that fish returning to the Middle Fork Salmon and Little Salmon have a more equal distribution of large and small fish.

B-run steelhead also are generally older. A-run steelhead are predominately 1-ocean fish, whereas most B-run steelhead generally spend 2 or more years in the ocean before spawning. The differences in ocean age are primarily responsible for the differences in the size of A- and B-run steelhead. However, B-run steelhead are also thought to be larger at any given age than A-run fish. This may be due, at least in part, to the fact that B-run steelhead leave the ocean later in the year than A-run steelhead and thus have an extra month or more of ocean residence when growth rates are thought to be greatest.

Historically, a distinctly bimodal pattern of freshwater entry could be used to distinguish A-run and B-run fish. A-run steelhead were presumed to cross Bonneville Dam from June to late August, whereas B-run steelhead entered from late August to October. The TAC reviewed the available information on timing and confirmed that most large fish still have a later timing at Bonneville; 70% of the larger fish crossed the dam after August 26, the traditional cutoff date for separating A- and B-run fish (TAC 1999). However, the timing of the early part of the A-run has shifted somewhat later, thereby reducing the distinction that was so apparent in the 1960s and 1970s. The timing of the larger, natural-origin, B-run fish has not changed.

As pointed out above, the geographic distribution of B-run steelhead is restricted to particular watersheds within the Snake River basin (areas of the mainstem Clearwater, Selway, and Lochsa rivers and the South and Middle Forks of the Salmon River). No recent genetic data are available for steelhead populations in the South and Middle Forks of the Salmon River. The Dworshak National Fish Hatchery (NFH) stock and natural populations in the Selway and Lochsa rivers are, thus far, the most genetically distinct populations of steelhead in the Snake River basin (Waples et al. 1993). In addition, the Selway and Lochsa River populations from the Middle Fork Clearwater appear to be very similar to each other genetically, and naturally produced rainbow trout from the North Fork Clearwater River (above Dworshak Reservoir) clearly show an ancestral genetic similarity to Dworshak NFH steelhead. The existing genetic data, the restricted geographic distribution of B-run steelhead in the Snake (Columbia) River basin, and the unique life history attributes of these fish (i.e. larger, older adults with a later distribution of run timing compared to A-run steelhead in other portions of the Columbia River basin) clearly support the conservation of B-run steelhead as a biologically significant component of the Snake River ESU.

NMFS also considers the status of the component populations as an indicator of the status of the ESU. For this purpose, a population is defined as a group of fish of the same species spawning in a particular lake or stream (or portion thereof) at a particular season, which to a substantial degree does not interbreed with fish from any other group spawning in a different place or in the same place during a different season. Because populations as defined here are relatively isolated, it is biologically meaningful to evaluate the risk of extinction of one population independently from any other. Some ESUs may consist of only one population, whereas others will consist of many. The background and guidelines related to the assessment of the status of populations are described in a recent draft report discussing the concept of viable salmonid populations (McElhany et al. 2000).

The task of identifying populations within an ESU requires making judgements based on the available information, including the geography, ecology, and genetics of the ESU. Although NMFS has not compiled and formally reviewed all the available information for this purpose, it is reasonable to conclude that, at a minimum, each of the major subbasins in the ESU represents a population within the context of this discussion. A-run populations would, therefore, include at least the tributaries to the lower Clearwater, the upper Salmon River and its tributaries, the lower Salmon River and its tributaries, the Grand Ronde, Imnaha, and possibly the Snake mainstem tributaries below Hells Canyon Dam. B-run populations would be identified in the

Middle Fork and South Fork Salmon rivers, the Lochsa and Selway rivers (major tributaries of the upper Clearwater), and possibly in the mainstem Clearwater River, as well. These basins are, for the most part, large geographical areas, and there probably is additional population structure within at least some of these basins. However, because that hypothesis has not been confirmed, NMFS assumes that there are at least five populations of A-run steelhead and five populations of B-run steelhead in the SR basin steelhead ESU. Escapement objectives for A- and B-run production areas in Idaho, based on estimates of smolt production capacity, are shown in Table A-9.

Table A-9. Adult steelhead escapement objectives based on estimates of 70% smolt production capacity.

A-Run Production Areas		B-Run Production Areas	
Upper Salmon	13,570	Middle Fork Salmon	9,800
Lower Salmon	6,300	South Fork Salmon	5,100
Clearwater	2,100	Lochsa	5,000
Grand Ronde	(1)	Selway	7,500
Imnaha	(1)	Clearwater	4,000
Total	**21,970**	**Total**	**31,400**

Note: comparable estimates are not available for populations in Oregon and Washington subbasins.

Hatchery populations, if genetically similar to their natural-origin counterparts, provide a hedge against extinction of the ESU or the gene pool. The Imnaha and Oxbow hatcheries produce A-run stocks that are currently included in the SR basin steelhead ESU. The Pahsimeroi and Wallowa hatchery stocks may also be appropriate and available for use in developing supplementation programs. In its recent biological opinion on Columbia basin hatchery operations, NMFS required that this program begin to transition to a local-origin broodstock to provide a source for future supplementation efforts in the lower Salmon River (NMFS 1999a). Although other stocks provide more immediate opportunities to initiate supplementation programs within some subbasins, it may also be necessary and desirable to develop additional broodstocks that can be used for supplementation in other natural production areas. Despite uncertainties related to the likelihood that supplementation programs can accelerate the recovery of naturally spawning populations, these hatchery stocks provide a safeguard against the further decline of natural-origin populations.

The Dworshak NFH is unique in the Snake River basin because it produces a B-run hatchery stock. The Dworshak stock was developed from natural-origin steelhead within the North Fork Clearwater River, was largely free of introductions from other areas, and was, therefore, included in the ESU, although not as part of the listed population. However, past hatchery practices and possibly changes in flow and temperature conditions related to Dworshak Dam have led to substantial divergence in spawn timing of the hatchery stock compared to what was observed historically in the North Fork Clearwater River and compared to natural-origin populations in other parts of the Clearwater basin. Because the spawn timing of the hatchery stock is now much earlier than it was historically (Figure A-6), the success of supplementation efforts using these stocks may be limited. In fact, past supplementation efforts in the South Fork

Clearwater River using Dworshak NFH stock have been largely unsuccessful, although improvements in out-planting practices have the potential to yield different results. In addition, the unique genetic character of Dworshak NFH steelhead noted above will limit the degree to which the stock can be used for supplementation in other parts of the Clearwater subbasin and particularly in the Salmon River B-run basins. Supplementation efforts in those areas, if undertaken, will more likely have to rely on the future development of local broodstocks. Supplementation opportunities in many of the B-run production areas will be limited in any case because of logistical difficulties in getting to and working in these high mountain wilderness areas. Because opportunities to accelerate the recovery of B-run steelhead through supplementation, even if successful, are expected to be limited, it is essential to maximize the escapement of natural-origin steelhead in the near term.

Finally, the conclusions and recommendations of the Technical Advisory Committee's All Species Review are pertinent to this review of the status of Snake River steelhead. Considering information available through 1996, the 1997 All Species Review stated:

> Regardless of assessment methods for A and B steelhead, it is apparent that the primary goal of enhancing the upriver summer steelhead run is not being achieved. The status of upriver summer steelhead, particularly natural-origin fish, has become a serious concern. Recent declines in all stocks, across all measures of abundance, are disturbing.
>
> There has been no progress toward rebuilding upriver runs since 1987. Throughout the Columbia River basin, dam counts, weir counts, spawning surveys, and rearing densities indicate natural-origin steelhead abundance is declining, culminating in the proposed listing of upriver stocks in 1996. Escapements have reached critically low levels despite the relatively high productivity of natural- and hatchery-rearing environments. Improved flows and ocean conditions should increase smolt-adult survival rates for upriver summer steelhead. However, reduced returns in recent years are likely to produce fewer progeny and lead to continued low abundance.
>
> Although steelhead escapements would have increased (in some years substantially) in the absence of mainstem fisheries, data analyzed by the Technical Advisory Committee indicate that effects other than mainstem Columbia River fishery harvest are primarily responsible for the currently depressed status and the long-term health and productivity of wild steelhead populations in the Columbia River.
>
> Though harvest is not the primary cause of declining summer steelhead stocks, and harvest rates have been below guidelines, harvest has further reduced escapements. Before 1990, the aggregate of upriver summer steelhead in the mainstem Columbia River at times appeared to have led to the failure to achieve escapement goals at Lower Granite Dam. Wild Group B steelhead are presently more sensitive to harvest than other salmon stocks, including the rest of the steelhead run, due to their depressed status and because they are caught at higher rates in the Zone 6 fishery.
>
> Small or isolated populations are much more susceptible to stochastic events such as drought and poor ocean conditions. Harvest can further increase the susceptibility of such populations. The Columbia River Fisheries Management Plan recognizes that harvest management must be responsive to run size and escapement needs to protect these populations. The parties should ensure that Columbia River Fisheries Management Plan harvest guidelines are sufficiently protective of weak stocks and hatchery broodstock requirements.

The All Species Review included the following recommendations:

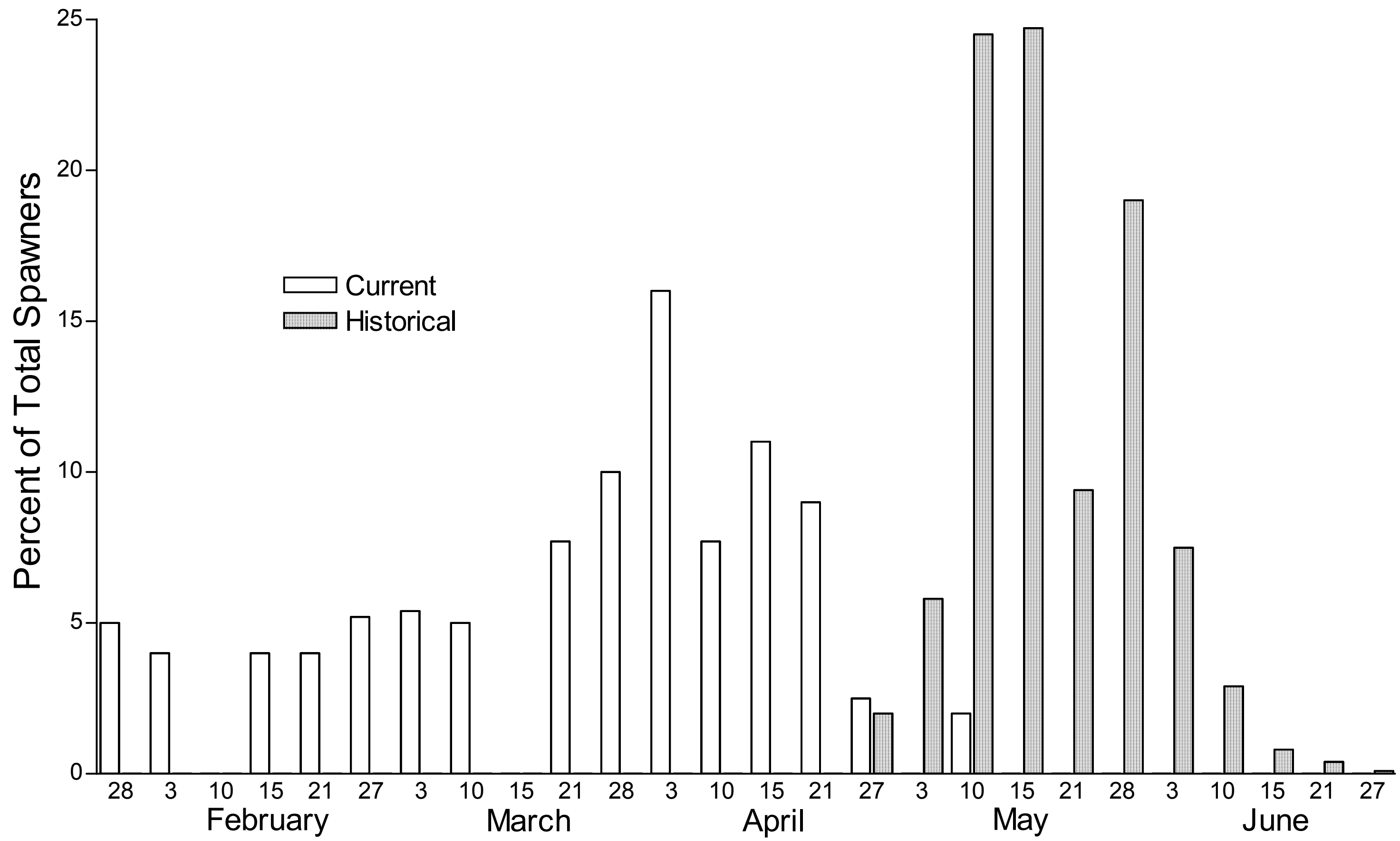
- Develop alternative harvest strategies to better achieve rebuilding and allocation objectives.

- Consider modification of steelhead harvest rate guidelines relative to stock management units and escapement needs.

For the SR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[9] ranges from 0.91 to 0.70, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000b). NMFS has also estimated the risk of absolute extinction for the A- and B-runs, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.01 for A-run steelhead and 0.93 for B-run fish (Table B-5 in McClure et al. 2000b). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is 1.00 for both runs (Table B-6 in McClure et al. 2000b).

[9] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1997 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

Figure A-6. Historical versus current spawn-timing of steelhead at Dworshak NFH.



A.4.2.2 Upper Columbia River Steelhead

UCR steelhead inhabit the Columbia River reach and its tributaries upstream of the Yakima River. This region includes several rivers that drain the east slopes of the Cascade Mountains and several that originate in Canada (only U.S. populations are included in the ESU). Dry habitat conditions in this area are less conducive to steelhead survival than in many other parts of the Columbia basin (Mullan et al. 1992a). Although the life history of this ESU is similar to that of other inland steelhead, smolt ages are some of the oldest on the West Coast (up to 7 years old), probably due to the ubiquitous cold water temperatures (Mullan et al. 1992b). Adults spawn later than in most downstream populations, remaining in freshwater up to a year before spawning.

Although runs from 1933 through 1959 may have already been affected by fisheries in the lower river, dam counts suggest a pre-fishery run size of more than 5,000 adults above Rock Island Dam. The return of UCR natural-origin steelhead to Priest Rapids Dam declined from a 5-year average of 2,700 beginning in 1986 to a 5-year average of 900 beginning in 1994 (FPC 2000; Table A-10). The escapement goal for natural-origin fish is 4,500. Most current natural production occurs in the Wenatchee and Methow river systems, with a smaller run returning to the Entiat River. Very limited spawning also occurs in the Okanagan River basin. Most of the fish spawning in natural production areas are of hatchery origin. Indications are that natural populations in the Wenatchee, Methow, and Entiat rivers are not self-sustaining.

This entire ESU has been subjected to heavy hatchery influence; stocks became thoroughly mixed as a result of the Grand Coulee Maintenance Project, which began in the 1940s (Fish and Hanavan 1948, Mullan et al. 1992a). Recently, as part of the development of the Mid-Columbia Habitat Conservation Plan (HCP), it was determined that steelhead habitat within the range of the Upper Columbia River ESU was overseeded, primarily due to the presence of Wells Hatchery fish in excess of those collected for broodstock. This would partially explain recent observations of low natural cohort replacement rates (0.3 for populations in the Wenatchee River and no greater than 0.25 for populations in the Entiat River; Bugert 1997). The problem of determining appropriate levels of hatchery output to prevent negative effects on natural production is a subject of analysis and review in the Mid-Columbia Quantitative Analytical Report (Cooney 2000). In the meantime, given these uncertainties, efforts are under way to diversify broodstocks used for supplementation and to minimize the differences between hatchery and natural-origin fish (as well as other concerns associated with supplementation). The best use for the Wells Hatchery program in the recovery process is yet to be defined and should be integrated with harvest activities and recovery measures to optimize the prospects for recovery of the species.

Due to data limitations, the QAR steelhead assessments in Cooney (2000) were limited to two aggregate spawning groups—the Wenatchee/Entiat composite and the above-Wells populations. Wild production of steelhead above Wells Dam was assumed to be limited to the Methow system. Assuming a relative effectiveness of hatchery spawners of 1.0, the risk of absolute extinction within 100 years for UCR steelhead is 100%. The QAR also assumed hatchery effectiveness values of 0.25 and 0.75. A hatchery effectiveness of 0.25 resulted in projected risks of extinction of 35% for the Wenatchee/Entiat and 28% for the Methow populations. At a hatchery effectiveness of 0.75, risks of 100% were projected for both populations.

For the UCR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[10] ranges from 0.94 to 0.66, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000b). NMFS has also estimated the risk of absolute extinction for the aggregate UCR steelhead population, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.25 (Table B-5 in McClure et al. 2000b). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is 1.00 (Table B-6 in McClure et al. 2000b).

Because of data limitations, the QAR steelhead assessments in Cooney (2000) were limited to two aggregate spawning groups—the Wenatchee/Entiat composite and the above-Wells populations. Wild production of steelhead above Wells Dam was assumed to be limited to the Methow system. Assuming a relative effectiveness of hatchery spawners of 1.0, the risk of absolute extinction within 100 years for UCR steelhead is 100%. The QAR also assumed hatchery effectiveness values of 0.25 and 0.75. A hatchery effectiveness of 0.25 resulted in projected risks of extinction of 35% for the Wenatchee/Entiat and 28% for the Methow populations. At a hatchery effectiveness of 0.75, risks of 100% were projected for both populations.

A.4.2.3 Middle Columbia River Steelhead

Life history information for MCR steelhead indicates that most fish smolt at 2 years of age and spend 1 to 2 years in salt water (i.e., 1-ocean and 2-ocean fish, respectively). After re-entering freshwater, they may remain up to a year before spawning (Howell et al. 1985). Within the ESU, the Klickitat River is unusual in that it produces both summer and winter steelhead, and the summer steelhead are dominated by 2-ocean steelhead (most other rivers in this region produce about equal numbers of both 1- and 2-ocean steelhead).

Escapement to the Yakima, Umatilla, and Deschutes subbasins have shown overall upward trends, although all tributary counts in the Deschutes River are downward, and the Yakima River is recovering from extremely low abundance in the early 1980s. The John Day River probably represents the largest native, natural-spawning stock in the ESU, and the combined spawner

[10] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1996 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

Table A-10. Adult summer steelhead counts at Priest Rapids, Rock Island, Rocky Reach, and Wells Dams (FPC 2000).

	Priest Rapids		Rock Island	Rocky Reach	Wells
Year	**Count**	**Wild Origin**	**Count**	**Count**	**Count**
1977	9,812		9,925	7,416	5,382
1978	4,545		3,352	2,453	1,621
1979	8,409		7,420	4,896	3,695
1980	8,524		7,016	4,295	3,443
1981	9,004		7,565	5,524	4,096
1982	11,159		10,150	6,241	8,418
1983	31,809		29,666	19,698	19,525
1984	26,076		24,803	17,228	16,627
1985	34,701		31,995	22,690	19,757
1986	22,382	2,342	22,867	15,193	13,234
1987	14,265	4,058	12,706	7,172	5,195
1988	10,208	2,670	9,358	5,678	4,415
1989	10,667	2,685	9,351	6,119	4,608
1990	7,830	1,585	6,936	5,014	3,819
1991	14,027	2,799	11,018	7,741	7,715
1992	14,208	1,618	12,398	7,457	7,120
1993	5,455	890	4,591	2,815	2,400
1994	6,707	855	5,618	2,823	2,138
1995	4,373	993	4,070	1,719	946
1996	8,376	843	7,305	5,774	4,127
1997	8,948	785	7,726	7,726	4,107
1998	5,837	—	4,962	4,442	2,668
1999	8,456[1]	1,428[1]	6,361	4,815	3,557

[1] Priest Rapids counts for 1999 from Brown (1999).

surveys for the John Day River have been declining at a rate of about 15% per year since 1985. However, estimates based on dam counts show an overall increase in steelhead abundance, with a relatively stable naturally produced component. NMFS, in proposing this ESU for listing as threatened under the ESA, cited low returns to the Yakima River, poor abundance estimates for Klickitat River and Fifteenmile Creek winter steelhead, and an overall decline for naturally producing stocks within the ESU.

Hatchery fish are widespread and stray to spawn naturally throughout the region. Recent estimates of the proportion of natural spawners of hatchery origin range from low (Yakima, Walla Walla, and John Day rivers) to moderate (Umatilla and Deschutes rivers). Most hatchery production in this ESU is derived primarily from within-basin stocks. One recent area of concern is the increase in the number of Snake River hatchery (and possibly wild) steelhead that stray and spawn naturally within the Deschutes River basin. Studies have been proposed to evaluate hatchery programs within the Snake River basin that experience high rates of straying into the Deschutes River and to make needed changes to minimize such straying to rivers within the MCR steelhead ESU.

The ESU is in the intermontane region and includes some of the driest areas of the Pacific Northwest, generally receiving less than 40 cm of rainfall annually (Jackson 1993). Vegetation is of the shrub-steppe province, reflecting the dry climate and harsh temperature extremes. Factors contributing to the decline of MCR steelhead include agricultural practices, especially grazing and water diversions/withdrawals. In addition, hydrosystem development has affected the ESU through loss of habitat above tributary hydro projects and through mortalities associated with migration through the Columbia River hydrosystem.

For the MCR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[11] ranges from 0.88 to 0.75, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000b). NMFS has also estimated the risk of absolute extinction for four of the subbasin populations, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from zero for the Yakima River summer run to 1.00 for the Umatilla River and Deschutes River summer runs (Table B-5 in McClure et al. 2000b). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years ranges from zero for the Yakima River summer run to 1.00 for the Deschutes River summer run (Table B-6 in McClure et al. 2000b).

A.4.2.4 Upper Willamette River Steelhead

[11] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period that varies between subbasin populations. Population trends are projected under the assumption that all conditions will stay the same into the future.

The UWR steelhead ESU occupies the Willamette River and its tributaries upstream of Willamette Falls. This is a late-migrating winter group, entering freshwater primarily during March and April (Howell et al. 1985). Only the late run is included in the ESU; the largest remaining population is in the Santiam River system. The North Santiam River hatchery stock (ODFW stock 21) is part of this ESU, but NMFS determined that it was not essential for recovery, and, therefore, listing was not warranted (64 FR 14525).

Steelhead in the UWR basin are heavily influenced by hatchery practices and introductions of non-native stocks, as well as introductions of native fish into new areas. Fishways built at Willamette Falls in 1885, modified and rebuilt several times, have facilitated the introduction of Skamania stock summer steelhead and early-migrating winter steelhead of Big Creek stock. Non-native production of summer steelhead appears quite low, and the summer population is almost entirely maintained by artificial production (Howell et al. 1985). Some naturally reproducing returns of Big Creek stock winter steelhead occur in the basin (primarily early stock; Table A-11). In recent years, releases of winter steelhead have been primarily native stock from the Santiam River system.

No estimates of abundance before the 1960s are available for this ESU. Recent run size can be estimated from redd counts, dam counts, and counts at Willamette Falls (late stock; Table A-11). Recent total-basin run size estimates exhibit general declines for winter steelhead. Most winter steelhead populations in this basin may not be self-sustaining.

Much of the Willamette River basin is urban or agricultural, and clearcut logging has been widespread in the watershed. Water temperatures and streamflows reach critical levels in the basin, and channel modification and bank erosion is substantial. Artificial production practices are a major threat to this ESU. Introgression from nonlocal winter hatchery stocks may occur. Artificial selection of later run timing may also result from competition with substantial numbers of hatchery fish and from selective fishing pressures.

For the UWR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[12] ranges from 0.94 to 0.87, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000b). NMFS has also estimated the risk of absolute extinction for four spawning aggregations, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from zero for the South Santiam River to 0.74 for the Calapooia River (Table B-5 in McClure et al. 2000b). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years ranges from 0.74 for the Calapooia River to 1.00 for the Molalla River and South Santiam River spawning aggregations (Table B-6 in McClure et al. 2000b).

[12] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1997 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

A.4.2.5 Lower Columbia River Steelhead

Busby et al. (1996) summarize the available information on the historical and recent abundances LCR steelhead. No estimates of historical abundance (pre-1960s) specific to this ESU are available. Because of their limited distribution in upper tributaries and the urbanization surrounding the lower tributaries (e.g., the lower Willamette, Clackamas, and Sandy rivers run through Portland, Oregon, or its suburbs), summer steelhead appear to be more at risk from habitat degradation than winter steelhead. Based on angler surveys during a limited period, populations in the lower Willamette, Clackamas, and Sandy rivers appear to be stable or increasing slightly, but these types of data may not reflect trends in underlying abundances. Total annual run size is only available for the Clackamas River population (1,300 winter steelhead, 70% hatchery; 3,500 summer steelhead).

Population dynamics indicate that the Oregon component of the LCR steelhead ESU is at risk such that the capacity to survive future periods of environmental stress is unacceptably low (Chilcote 1998). The recent collapse of winter steelhead in the Clackamas River and the status of summer steelhead in the Hood River (which together comprise 33% of the ESU) are of special concern. The Kalama River population is the only one in Washington State considered healthy (WDFW 1997). All of the other winter steelhead populations (i.e., those in the Cowlitz, Coweeman, North Fork and South Fork Toutle, Green, North Fork Lewis, and Washougal rivers) are considered depressed (WDFW 1997). The status of populations of winter steelhead in Hamilton Creek and the Wind River is unknown. The WDFW trapped fish at Shiperd Falls on the Wind River during winter 1999-2000 and will use these data to develop preliminary estimates of steelhead abundance. Among summer steelhead, populations from the Kalama

Table A-11. Escapement of winter steelhead over Willamette Falls and over North Fork Dam on the Clackamas River, 1971 through 1998.

	Willamette Falls Count			
Year[1]	Total	Early Stock[2]	Late Stock[3]	North Fork Dam
1971	26,647	8,152	18,495	4,352
1972	23,257	6,572	16,685	2,634
1973	17,900	6,389	11,511	1,899
1974	14,824	5,733	9,091	680
1975	6,130	3,096	3,034	1,509
1976	9,398	4,204	5,194	1,488
1977	13,604	5,327	8,277	1,525
1978	16,869	8,599	8,270	2,019
1979	8,726	2,861	5,865	1,517
1980	22,356	6,258	16,097	2,065
1981	16,666	7,662	9,004	2,700
1982	13,011	6,117	6,894	1,446
1983	9,298	4,596	4,702	1,099
1984	17,384	6,664	10,720	1,238
1985	20,592	4,549	16,043	1,225
1986	21,251	8,475	12,776	1,432
1987	16,765	8,543	8,222	1,318
1988	23,378	8,371	15,007	1,773
1989	9,572	4,211	5,361	1,251
1990	11,107	1,878	9,229	1,487
1991	4,943	2,221	2,722	837
1992	5,396	1,717	3,679	2,107
1993	3,568	843	2,725	1,352
1994	5,300	1,025	4,275	1,247
1995	4,693	1,991	2,702	1,146
1996	1,801	479	1,322	325
1997	4,544	619	3,925	530
1998	3,678	757	2,921	504

[1] Represents year in which passage is completed. Passage began during the previous year. Total estimates of passage were not obtained before 1971 due to problems of access to the old fishway during higher flow periods.
[2] November 1 through February 15. These are mainly introduced Big Creek stock.
[3] February 16 through May 15. These are mainly indigenous Willamette stock.

River, the North and East Forks of the Lewis River, and the Washougal River are considered depressed, and the Wind River stock is classified as critical (WDFW 1997).

Recent estimates of the proportion of hatchery fish on the winter-run steelhead spawning grounds are more than 80% in the Hood and Cowlitz rivers and 45% in the Sandy, Clackamas, and Kalama rivers. On the summer-run steelhead spawning grounds in the Kalama River, hatchery fish make up approximately 75% of the total run. Out of 14 steelhead populations for which data are available, only 3 have no hatchery influence: the Washougal River summer run and the Panther and Trout Creek runs in the Wind River basin. NMFS is unable to identify any natural populations of steelhead in this ESU that could be considered healthy, especially in light of new genetic data from WDFW that indicate some introgression between the Puget Sound Chambers Creek Hatchery stock and wild steelhead in this ESU (Phelps et al. 1997). In addition, summer steelhead, native to the Hood, Lewis, Washougal and Kalama rivers, have been introduced into the Sandy and Clackamas rivers. Naturally spawning populations of winter steelhead appear to have been negatively affected by these introductions, probably through interbreeding and competition (Chilcote 1998).

For the LCR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[13] ranges from 0.98 to 0.78, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000b). NMFS has also estimated the risk of absolute extinction for seven of the spawning aggregations, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from zero for the Kalama River summer run and the Clackamas River and Kalama River winter runs to 1.00 for the Clackamas River summer run and the Toutle River winter run (Table B-5 in McClure et al. 2000b). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years rises to 1.00 for all but one population (the risk of extinction is 0.86 for the Green River winter run; Table B-6 in McClure et al. 2000b).

[13] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period that varies between spawning aggregations. Population trends are projected under the assumption that all conditions will stay the same into the future.

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A.4.3 CHUM SALMON

A.4.3.1 Columbia River Chum Salmon

The Columbia River historically contained large runs of chum salmon that supported a substantial commercial fishery in the first half of this century. These landings represented an annual harvest of more than 500,000 chum salmon as recently as 1942. Beginning in the mid-1950s, commercial catches declined drastically and in later years rarely exceeded 2,000 per year. Annual catch, as incidental take in the late fall mainstem Columbia River fishery, has been less than 50 fish since 1994.

Fulton (1970) reported that chum salmon used 22 of 25 historical spawning areas in the lower Columbia River below The Dalles Dam. Even at the time of publication, access to suitable tributary habitat was limited by natural (falls, heavy rubble, and boulders) and manmade structures (dams and water diversions). Habitat quality was limited by siltation where watersheds had been subjected to heavy logging. Currently, spawning is limited to tributaries below Bonneville Dam, with most spawning in two areas on the Washington side of the Columbia River: Grays River, near the mouth of the Columbia River, and Hardy and Hamilton creeks, approximately 3 miles below Bonneville Dam. Some chum salmon pass Bonneville Dam, but there are no known extant spawning areas in Bonneville pool. Grays River chum salmon enter the Columbia River from mid-October to mid-November, but do not reach the Grays River until late October to early December. These fish spawn from early November to late December. Fish returning to Hamilton and Hardy creeks begin to appear in the Columbia River earlier than Grays River fish (late September to late October) and have a more protracted spawn timing (mid-November to mid-January).

The estimated minimum run size for the Columbia River ESU has been relatively stable, although at a very low level, since the run collapsed during the mid-1950s (Figure A-7). Current abundance is probably less than 1% of historical levels, and the ESU has undoubtedly lost some (perhaps much) of its original genetic diversity. Average annual natural escapement to the index spawning areas was approximately 1,300 fish from 1990 through 1998 (ODFW and WDFW 1999).

Index spawning areas are located in the Grays River system, near the mouth of the Columbia River, and in the Hardy Creek/Hamilton Creek/Ives Island complex below Bonneville Dam. WDFW surveyed other (nonindex) areas in 1998 and found only small numbers of chum salmon (typically less than 10 fish per stream) in Elochoman, Abernathy, Germany, St. Cloud, and Tanner creeks and in the North Fork Lewis and the Washougal rivers. The state of Oregon does not conduct targeted surveys, so the current extent of chum salmon spawning on the Oregon side of the river is unknown. Kostow (1995) cited reports of 23 spawning areas in Oregon tributaries, but these are based on incidental observations (pers. comm., K. Kostow, Fisheries Biologist, ODFW, Portland, Oregon, August 6, 1999).

In the Grays system, chum salmon spawn in the mainstem from approximately ½-mile upstream of the West Fork downstream to the Covered Bridge, a distance of approximately 4 miles (WDF et al. 1993a). Tributary spawning occurs in the West Fork, Crazy Johnson, and Gorely creeks. The historical influence of hatchery fish in the Grays system is small compared to other ESUs. Hatchery-cultured chum salmon from Willapa Bay (i.e., Pacific Coast chum salmon ESU) were transplanted into the Chinook River (a tributary to Baker Bay in the Columbia River estuary) during the late 1980s. Initial returns from this transplant were close to a thousand fish per year, but recent returns have been substantially lower (less than or equal to 20 fish per year during 1997 and 1998). In 1998, WDFW decided that non-native chum salmon should be removed from the system. Consequently, all Willapa Bay chum salmon returning to the Sea Resources Hatchery during 1999 were destroyed. The Sea Resources and Grays River hatcheries are now used to culture Columbia River chum salmon (collected from Gorely Creek) for reintroduction into the Chinook River. Overall, the abundance of the Grays River population has increased since the mid-1980s, but appears to follow a cyclical pattern. The average population rate of growth is positive (McClure et al. 2000), but the cyclical trend results in a high variability around the average estimate.

The Hardy and Hamilton creeks/Ives Island complex is located approximately 2 miles below Bonneville Dam. Hamilton Slough once separated Hamilton Island from the Washington State shoreline. Sometime before 1978, a dike was built across the slough, separating its upstream and downstream ends (Corps 1978). The waterway that now appears to be the lower end of Hamilton Creek is actually the downstream end of the former slough; the mouth of Hamilton Creek proper adjoins the remnant slough at its northern terminus. These large-scale landscape modifications have probably changed the hydraulics of the Hamilton Slough/Ives Island spawning area.

Escapements to Hamilton Creek have averaged less than 100 fish in recent years. WDFW recently completed a major habitat development project in Hamilton Springs, a spring-fed tributary to Hamilton Creek. Chum salmon escapement to Hamilton Springs averaged 170 fish during the last 3 years (1997 through 1999; Figure A-8). Hardy Creek is located just downstream of Hamilton Creek. Annual escapements have ranged from 22 to 1,153 spawners over the last 10 years, with a generally increasing trend. Hardy Creek is now incorporated into the Pierce National Wildlife Refuge, and chum salmon have benefited from recent (and ongoing) habitat improvement programs (a vehicle bridge over Hardy Creek, cattle fencing, and development of additional spawning gravels).

The current upstream extent of spawning by Columbia River chum salmon, and thus the effect of Bonneville Dam as a barrier to migration, is unknown. Adult chum salmon are thought to show little persistence in surmounting river blockages and falls (63 FR 11775). The 10-year average (1989 through 1998) count for the fish ladders at Bonneville Dam was 56 adults (Table A-12), although this statistic is heavily skewed by a count of 195 chum salmon in 1998 (J. Loch, WDFW, unpubl. data). The unusually high count was due to (1) an increase in the effort applied to reviewing the videotapes for observations of chum salmon and (2) unusually high activity in the fish ladders at night, possibly related to unusual temperature conditions in Bonneville pool (pers. comm., J. Loch, WDFW, January 28, 2000). Without the 1998 data, the 9-year average would be only 31 adult chum salmon. Information on chum salmon passage at Bonneville Dam is extremely important because the passage of large numbers of adults over Bonneville implies that chum salmon may be spawning in Bonneville pool (and Federal hydrosystem operations could affect the quantity and quality of such spawning habitat).

Hatchery fish have had little influence on the wild component of the CR chum salmon ESU. NMFS estimates a median population growth rate (lambda) over the base period,[14] for the ESU as a whole, of 1.04 (Tables B-2a and B-2b in McClure et al. 2000b). Because census data are peak counts (and because the precision of those counts decreases markedly during the spawning season as water levels and turbidity rise), NMFS is unable to estimate the risk of absolute extinction for this ESU.

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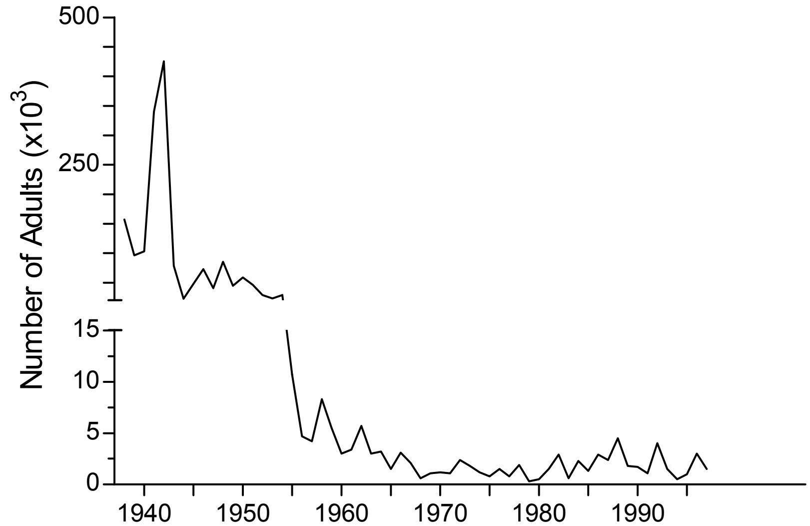
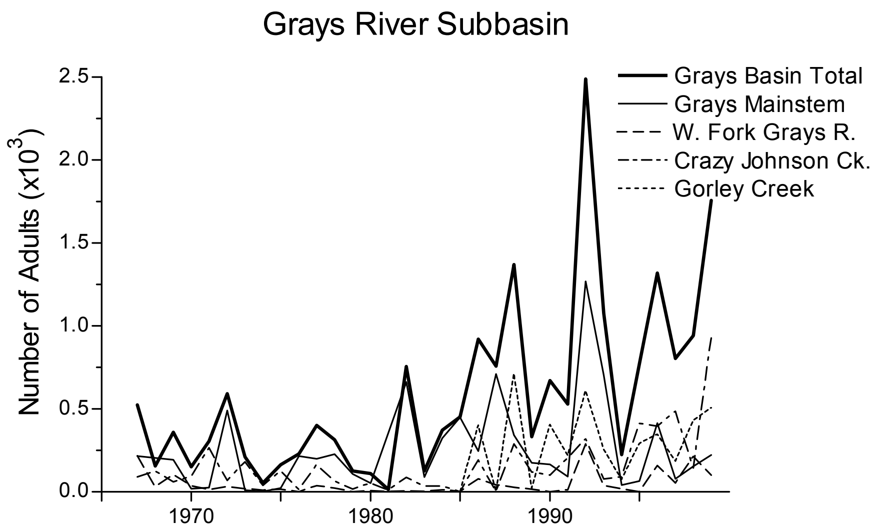
[14] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period from 1980 through 1998 adult returns for the Grays River mainstem and the West Fork, Crazy Johnson, and Hamilton Creek spawning aggregations and including the 1999 adult returns for Hardy Creek and Hamilton Springs. Population trends are projected under the assumption that all conditions will stay the same into the future.

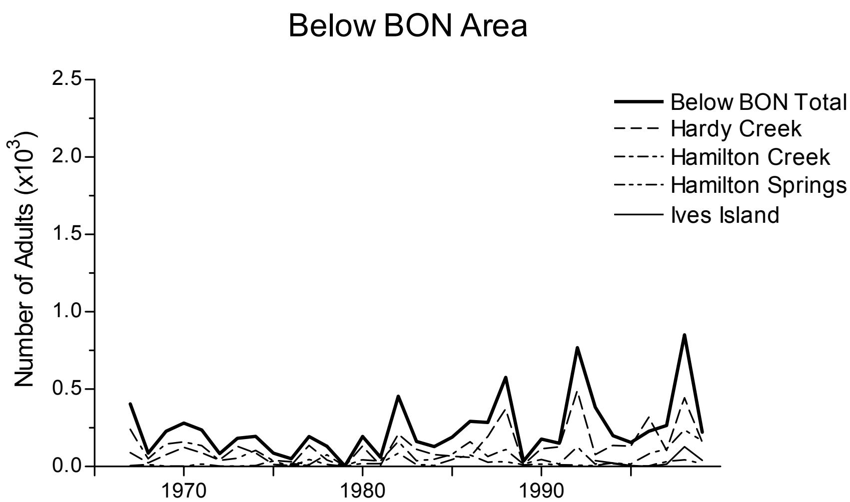
Figure A-7. Minimum run size for Columbia River chum salmon, 1938 to 1998.



Note: These values were calculated by summing harvest, spawner surveys, and Bonneville Dam counts. Data are from ODFW and WDFW (1999).

Figure A-8. Peak counts of adult chum salmon in index spawning areas, 1967 through 1999.





Source: WDFW and USFWS, unpublished data.

Table A-12. Chum salmon counted in the Bonneville Dam adult fish ladders (1989 through 1998).

Year	Total Number
1989[1]	16
1990[1]	26
1991[1]	5
1992[2]	39
1993[2]	51
1994[2]	26
1995[2]	30
1996[2]	33
1997[3]	50
1998[4]	195
1999[4]	135

Source: J. Loch, WDFW, unpublished data. The following footnotes were provided by J. Loch:

1 Only daytime videos available for November 1989 through 1991 (8 a.m. to 4 p.m.).

2 Wild steelhead were the target species recorded from nighttime videotapes by WDFW readers. Non-target species (e.g., chum salmon) were not always recorded.

3 Wild steelhead were again the target species but some non-target species may have been recorded. Note: Data for non-target species were not included in the Corps' Annual Fish Passage reports.

4 1998 was the first year that the Corps contracted with the WDFW counting program to read videotapes for all salmonids. Although wild steelhead remained the target species for the video count program, observations of chum salmon, pink salmon, and chinook salmon were also tallied by the video reader. All counts were included in the Corps' annual reports for 1998 and 1999.

A.4.4 Sockeye Salmon

A.4.4.1 Snake River Sockeye Salmon

Historically, Snake River sockeye salmon were produced in the Salmon River subbasin in Alturas, Pettit, Redfish, and Stanley lakes and in the South Fork Salmon River subbasin in Warm Lake. Sockeye salmon may have been present in one or two other Stanley basin lakes (Bjornn et al. 1968). Elsewhere in the Snake River basin, sockeye salmon were produced in Big Payette Lake on the North Fork Payette River and in Wallowa Lake on the Wallowa River (Evermann 1895, Toner 1960, Bjornn et al. 1968, Fulton 1970).

The largest single sockeye salmon spawning area was in the headwaters of the Payette River, where 75,000 were taken one year by a single fishing operation in Big Payette Lake. However, access to production areas in the Payette basin was eliminated by construction of Black Canyon Dam in 1924. During the 1980s, returns to headwaters of the Grand Ronde River in Oregon (Wallowa Lake) were estimated to have been at least 24,000 and 30,000 sockeye salmon (Cramer 1990), but access to the Grand Ronde was eliminated by construction of a dam on the outlet to Wallowa Lake in 1929. Access to spawning areas in the upper Snake River basin was eliminated in 1967 when fish were no longer trapped and transported around the Hells Canyon Dam complex. All of these dams were constructed without fish passage facilities.

There are no reliable estimates of the number of sockeye salmon spawning in Redfish Lake at the turn of the century. However, beginning in 1910, access to all lakes in the Stanley basin was seriously reduced by the construction of Sunbeam Dam, 20 miles downstream from Redfish Lake Creek on the mainstem Salmon River. The original adult fishway, constructed of wood, was ineffective at passing fish over the dam. It was replaced with a concrete structure in 1920, but sockeye salmon access was impeded until the dam was partially removed in 1934. Even after fish passage was restored at Sunbeam Dam, sockeye salmon were unable to use spawning areas in two of the lakes in the Stanley basin. Welsh (1991) reported fish eradication projects in Pettit Lake (treated with toxaphene in 1960) and Stanley Lake (treated with Fish-Tox, a mixture of rotenone and toxaphene, in 1954). Agricultural water diversions cut off access to most of the lakes. Bjornn et al. (1968) stated that, during the 1950s and 1960s, Redfish Lake was probably the only lake in Idaho that was still used by sockeye salmon each year for spawning and rearing, and, at the time of listing under ESA, sockeye salmon were produced naturally only in Redfish Lake.

Escapement to the Snake River has declined dramatically in the last several decades. Adult counts at Ice Harbor Dam declined from 3,170 in 1965 to zero in 1990 (ODFW and WDFW 1998). The Idaho Department of Fish and Game counted adults at a weir in Redfish Lake Creek during 1954 through 1966; adult counts dropped from 4,361 in 1955 to fewer than 500 after 1957 (Bjornn et al. 1968). A total of 16 wild sockeye salmon returned to Redfish Lake between 1991 and 1999 (Table A-13). During 1999, seven hatchery-produced, age-3 adults returned to the Sawtooth Hatchery. Three of these adults were released to spawn naturally, and four were taken into the IDFG captive broodstock program. In 2000, 257 hatchery-produced, age-4 sockeye salmon returned to the Stanley basin (weirs at the Sawtooth Hatchery and Redfish Lake Creek). Adults numbering 243 were handled and redistributed to Redfish (120), Alturas (52), and Pettit (28) lakes, with the remaining 43 adults incorporated into the IDFG captive broodstock program at Eagle Hatchery.

Low numbers of adult Snake River sockeye salmon preclude a CRI- or QAR-type quantitative analysis of the status of this ESU. However, because only16 wild and 264 hatchery-produced adult sockeye returned to the Stanley basin between 1990 and 2000, NMFS considers the status of this ESU to be dire under any criteria.

Table A-13. Returns of Snake River sockeye salmon to Lower Granite Dam and to the weir at Redfish Lake Creek. The 2000 return is the total number of adults returning to the Stanley basin (weirs at the Sawtooth Hatchery and Redfish Lake Creek).

Year	LGR Dam Count	Adults at Weirs
1986	15	29
1987	29	16
1988	23	4
1989	2	1
1990	0	0
1991	8	4
1992	15	1
1993	12	8
1994	5	1
1995	3	0
1996	3	1
1997	11	0
1998	2	1
1999	14	7
2000	282	257

Sources: Lower Granite Dam counts from FPC (2000); Redfish Lake Creek/Stanley basin counts from StreamNet (2000).

A.5 Extinction Analysis

Analyses were performed to evaluate the possibility of future distinction and/or decline for individual stocks of listed salmonids (Tables A-14 and A-15). This evaluation was performed using the [Dennis Extinction Analysis model]. Table A-14 incorporated the percent spawners that were hatchery but assumed that hatchery fish do not reproduce, whereas Table A-15 used the same analysis but assumed that hatchery fish produce the same number of offspring as wild born fish.

Table A-14. Results of Dennis Extinction Analysis for individual stocks. Two thresholds (1fish/generation, 90% decline). This analysis incorporated the % spawners that were hatchery but assumed that hatchery fish do not reproduce. NA indicates that no hatchery data were available, that the data failed the sigma^2 > 0 test, or that the data are index counts and are not appropriate for population size estimates.

							Extinction			**90% decline**			
Species	ESU	Stream	pop size est	μ	σ2	λ	24 year Risk Metric	48 year Risk Metric	100 year Risk Metric	24 year Risk Metric	48 year Risk Metric	100 year Risk Metric	NA Comments
Chinook	**Lower Columbia**	Bear Creek	253	-0.138	0.199	0.871	0.21	0.73	0.98	0.68	0.92	0.99	var plot not very linear
		Big Creek	2982	-0.023	0.039	0.977	0.00	0.00	0.00	0.03	0.19	0.50	
		Clatskanie	28	-0.069	0.439	0.933	0.48	0.71	0.88	0.42	0.59	0.76	
		Cowlitz Tule	NA	-0.028	0.103	0.972	NA	NA	NA	0.15	0.33	0.56	index data;
		Elochoman	NA	0.041	0.435	1.042	NA	NA	NA	0.15	0.18	0.18	index data;
		Germany	NA	-0.021	0.140	0.979	NA	NA	NA	0.16	0.31	0.48	index data; var plot not very linear
		Gnat	105	-0.016	0.453	0.984	0.18	0.37	0.57	0.28	0.37	0.46	
		Grays Tule	NA	-0.108	0.418	0.897	NA	NA	NA	0.54	0.74	0.91	index data;
		Kalama Spring	NA	-0.117	0.142	0.889	NA	NA	NA	0.61	0.90	0.99	index data; var plot not very linear
		Kalama	NA	0.034	0.517	1.035	NA	NA	NA	0.19	0.21	0.21	index data;
		Klaskanine	27	-0.067	0.273	0.935	0.40	0.67	0.88	0.39	0.60	0.80	var plot not very linear
		Lewis R Bright	NA	-0.009	0.043	0.991	NA	NA	NA	0.02	0.10	0.25	index data;
		Lewis Spring	NA	-0.052	0.417	0.950	NA	NA	NA	0.37	0.52	0.67	index data;
		Lewis, E Fk Tule	NA	-0.008	0.021	0.992	NA	NA	NA	0.00	0.03	0.14	index data;
		Mill Fall	307	-0.164	0.179	0.849	0.25	0.83	1.00	0.78	0.97	1.00	var plot not very linear
		Plympton	2991	-0.002	0.144	0.998	0.00	0.00	0.04	0.11	0.20	0.29	
		Sandy Late	4135	-0.016	0.015	0.984	0.00	0.00	0.00	0.00	0.03	0.28	
		Sandy Tule	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not enough data
		Skamokawa	NA	-0.146	0.041	0.864	NA	NA	NA	0.89	1.00	1.00	index data;
		Youngs	19	-0.012	1.043	0.988	0.58	0.70	0.80	0.34	0.40	0.46	

Table A-14. continued

Species	ESU	Stream	pop size est	μ	σ2	λ	Extinction 24 year Risk Metric	48 year Risk Metric	100 year Risk Metric	90% decline 24 year Risk Metric	48 year Risk Metric	100 year Risk Metric	NA Comments
Chinook	**U. Columbia Spr**	Methow River	324	-0.141	0.264	0.868	0.24	0.71	0.97	0.67	0.90	0.99	
		Entiat	159	-0.138	0.031	0.871	0.03	0.92	1.00	0.88	1.00	1.00	
		Wenatchee	745	-0.216	0.022	0.806	0.03	1.00	1.00	1.00	1.00	1.00	
Chinook	**Snake R. Spr/Sum**	Bear Creek	736	0.017	0.146	1.017	0.00	0.00	0.03	0.07	0.12	0.15	
		Imnaha River	657	-0.078	0.041	0.925	0.00	0.03	0.78	0.33	0.85	1.00	
		Johnson Creek	457	0.010	0.048	1.010	0.00	0.00	0.00	0.01	0.03	0.07	
		Marsh Creek	291	-0.013	0.127	0.987	0.00	0.04	0.19	0.13	0.25	0.39	
		Minam River	338	-0.005	0.156	0.995	0.00	0.04	0.17	0.13	0.23	0.33	
		Poverty Creek	1051	0.006	0.080	1.006	0.00	0.00	0.01	0.04	0.09	0.16	
		Sulphur Creek	207	0.039	0.411	1.040	0.05	0.12	0.21	0.15	0.17	0.17	
Chinook	**Snake R. Basin Fall**	Snake River Basin	1505	-0.064	0.051	0.938	0.00	0.00	0.40	0.24	0.69	0.96	
Chinook	**Upper Williamette**	McKenzie River above Leaburg Dam	4704	0.030	0.206	1.031	0.00	0.00	0.01	0.09	0.12	0.12	
Chum	**Columbia River**	Grays R west fork	NA	0.209	0.205	1.233	NA	NA	NA	0.00	0.00	0.00	index data; var plot not very linear
		Grays R mouth to head	NA	-0.045	0.125	0.956	NA	NA	NA	0.24	0.48	0.73	index data; var plot not very linear
		Hardy Creek	NA	0.045	0.061	1.046	NA	NA	NA	0.00	0.00	0.00	index data; var plot not very linear

Table A-14. continued

Species	ESU	Stream	pop size est	μ	σ2	λ	Extinction 24 year Risk Metric	Extinction 48 year Risk Metric	Extinction 100 year Risk Metric	90% decline 24 year Risk Metric	90% decline 48 year Risk Metric	90% decline 100 year Risk Metric	NA Comments
		Crazy J	NA	0.146	0.031	1.158	NA	NA	NA	0.00	0.00	0.00	index data; var plot not very linear
		Hamilton	NA	-0.084	0.054	0.919	NA	NA	NA	0.40	0.86	1.00	index data; var plot not very linear
		Hamilton Springs	NA	0.106	0.590	1.112	NA	NA	NA	0.10	0.10	0.10	index data;
Steelhead	**Lower Columbia**	Clackamas Sum	2720	-0.112	0.011	0.894	0.00	0.00	1.00	0.77	1.00	1.00	
		Clackamas Win	937	-0.040	0.004	0.961	0.00	0.00	0.00	0.00	0.20	1.00	var plot not very linear
		Coweeman Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not enough data
		Eagle Ck Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Green River Win	660	-0.102	0.212	0.903	0.06	0.40	0.86	0.53	0.79	0.96	
		Hood River Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Hood River Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Kalama Sum	5902	0.035	0.030	1.035	0.00	0.00	0.00	0.00	0.00	0.00	
		Kalama River Win	4228	0.006	0.007	1.006	0.00	0.00	0.00	0.00	0.00	0.00	
		Lewis River Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Panther Ck Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not enough data
		Sandy Win	3471	-0.057	0.028	0.944	0.00	0.00	0.09	0.13	0.65	0.98	
		Toutle Win	3008	-0.133	0.001	0.875	0.00	0.00	1.00	1.00	1.00	1.00	var plot not very linear
		TroutCk Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not enough data
		Washougal Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data

Table A-14. continued								Extinction			90% decline		
Species	ESU	Stream	pop size est	μ	σ2	λ	24 year Risk Metric	48 year Risk Metric	100 year Risk Metric	24 year Risk Metric	48 year Risk Metric	100 year Risk Metric	NA Comments
		Washougal River Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Wind Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not enough data
Steelhead	**Mid Columbia**	Beaver Creek Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Deschutes R Sum	9157	-0.146	0.004	0.864	0.00	0.00	1.00	1.00	1.00	1.00	
		Mill Ck Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Shitike Ck Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Warm Springs Nfh Sum	1031	-0.098	0.050	0.907	0.00	0.09	0.92	0.52	0.94	1.00	
		Eightmile Ck Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Ramsey Ck Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Fifteen Mile Ck Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Touchet R Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not enough data
		Umtilla R Sum	5867	-0.111	0.003	0.895	0.00	0.00	1.00	0.91	1.00	1.00	var plot not very linear
		Yakima R Sum	5213	0.044	0.017	1.045	0.00	0.00	0.00	0.00	0.00	0.00	
Steelhead	**Upper Columbia**	Upper Columbia River	2137	-0.061	0.040	0.941	0.00	0.00	0.25	0.19	0.67	0.97	
Steelhead	**Snake R. Basin**	Snake River Sthead A-run	33603	-0.078	0.011	0.925	0.00	0.00	0.01	0.20	0.97	1.00	

Table A-14. continued

Species	ESU	Stream	pop size est	μ	σ2	λ	Extinction 24 year Risk Metric	Extinction 48 year Risk Metric	Extinction 100 year Risk Metric	90% decline 24 year Risk Metric	90% decline 48 year Risk Metric	90% decline 100 year Risk Metric	NA Comments
		Snake River Sthead B-run	11833	-0.114	0.023	0.892	0.00	0.00	0.93	0.73	1.00	1.00	
Steelhead	**Upper Williamette**	Mollala	2010	-0.054	0.075	0.948	0.00	0.01	0.27	0.23	0.56	0.87	
		N Santiam R	4690	-0.075	0.056	0.927	0.00	0.00	0.40	0.33	0.79	0.99	
		S Santiam	3730	-0.030	0.029	0.971	0.00	0.00	0.00	0.03	0.23	0.65	
		Calapooia	416	-0.075	0.188	0.928	0.04	0.29	0.74	0.41	0.67	0.88	

Table A-15. Results of Dennis Extinction Analysis for individual stocks. Two thresholds (1fish/generation, 90% decline). This analysis incorporated the % spawners that were hatchery and assumed that hatchery fish produce the same number of offspring as wild born fish. NA indicates that no hatchery data were available, that the data failed the sigma^2 > 0 test, or that data are index counts which are inappropriate for a population size estimate.

							Extinction			**90% decline**			
Species	ESU	Stream	pop size est	μ	σ2	λ	24 year Risk Metric	48 year Risk Metric	100 year Risk Metric	24 year Risk Metric	48 year Risk Metric	100 year Risk Metric	NA Comments
Chinook	**Lower Columbia**	Bear Creek	507	-0.348	0.199	0.706	0.87	1.00	1.00	1.00	1.00	1.00	var plot not very linear
		Big Creek	5964	-0.198	0.039	0.820	0.00	0.75	1.00	0.99	1.00	1.00	
		Clatskanie	57	-0.257	0.439	0.773	0.84	0.99	1.00	0.88	0.99	1.00	
		Cowlitz Tule	NA	-0.223	0.103	0.800	NA	NA	NA	0.97	1.00	1.00	index data;
		Elochoman	NA	-0.157	0.435	0.855	NA	NA	NA	0.68	0.87	0.98	index data;
		Germany	NA	-0.210	0.140	0.811	NA	NA	NA	0.93	1.00	1.00	index data; var plot not very linear
		Gnat	211	-0.201	0.453	0.818	0.55	0.90	0.99	0.78	0.94	1.00	
		Grays Tule	NA	-0.305	0.418	0.737	NA	NA	NA	0.94	1.00	1.00	index data;
		Kalama Spring	NA	-0.301	0.142	0.740	NA	NA	NA	1.00	1.00	1.00	index data; var plot not very linear
		Kalama	NA	-0.150	0.517	0.861	NA	NA	NA	0.64	0.84	0.96	index data;
		Klaskanine	54	-0.256	0.273	0.774	0.87	1.00	1.00	0.93	1.00	1.00	var plot not very linear
		Lewis R Bright	NA	-0.031	0.043	0.969	NA	NA	NA	0.06	0.29	0.65	index data;
		Lewis Spring	NA	-0.232	0.417	0.793	NA	NA	NA	0.85	0.98	1.00	index data;
		Lewis, E Fk Tule	NA	-0.008	0.021	0.992	NA	NA	NA	0.00	0.03	0.14	index data;
		Mill Fall	615	-0.352	0.179	0.703	0.87	1.00	1.00	1.00	1.00	1.00	var plot not very linear
		Plympton	5983	-0.183	0.144	0.833	0.01	0.57	1.00	0.87	0.99	1.00	
		Sandy Late	4263	-0.024	0.015	0.976	0.00	0.00	0.00	0.00	0.09	0.53	
		Sandy Tule	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not enough data
		Skamokawa	NA	-0.335	0.041	0.715	NA	NA	NA	1.00	1.00	1.00	index data;
		Youngs	38	-0.201	1.043	0.818	0.78	0.92	0.99	0.69	0.85	0.96	

Table A-15. continued

Species	ESU	Stream	pop size est	μ	σ2	λ	Extinction 24 year Risk Metric	Extinction 48 year Risk Metric	Extinction 100 year Risk Metric	90% decline 24 year Risk Metric	90% decline 48 year Risk Metric	90% decline 100 year Risk Metric	NA Comments
Chinook	**U. Columbia Spr**	Methow River	433	-0.172	0.214	0.842	0.25	0.82	1.00	0.79	0.97	1.00	
		Entiat	173	-0.222	0.041	0.801	0.60	1.00	1.00	1.00	1.00	1.00	
		Wenatchee	805	-0.231	0.025	0.794	0.08	1.00	1.00	1.00	1.00	1.00	var plot not very linear
Chinook	**Snake R. Spr/Sum**	Bear Creek	736	0.017	0.146	1.017	0.00	0.00	0.03	0.07	0.12	0.15	
		Imnaha River	1175	-0.137	0.030	0.872	0.00	0.37	1.00	0.88	1.00	1.00	
		Johnson Creek	457	0.010	0.048	1.010	0.00	0.00	0.00	0.01	0.03	0.07	
		Marsh Creek	291	-0.013	0.127	0.987	0.00	0.04	0.19	0.13	0.25	0.39	
		Minam River	582	-0.082	0.167	0.921	0.02	0.27	0.77	0.43	0.72	0.93	
		Poverty Creek	1055	-0.011	0.097	0.989	0.00	0.00	0.05	0.09	0.21	0.35	
		Sulphur Creek	207	0.039	0.411	1.040	0.05	0.12	0.21	0.15	0.17	0.17	
Chinook	**Snake R. Basin Fall**	Snake River Basin	2199	-0.152	0.012	0.859	0.00	0.31	1.00	0.99	1.00	1.00	var plot not very linear
Chinook	**Upper Williamette**	McKenzie River above Leaburg Dam	6859	-0.128	0.237	0.880	0.01	0.28	0.85	0.63	0.87	0.98	
Chum	**Columbia River**	Grays R west fork	NA	0.209	0.205	1.233	NA	NA	NA	0.00	0.00	0.00	index data; var plot not very linear
		Grays R mouth to head	NA	-0.045	0.125	0.956	NA	NA	NA	0.24	0.48	0.73	index data; var plot not very linear

Table A-15. continued

Species	ESU	Stream	pop size est	µ	σ2	λ	Extinction 24 year Risk Metric	Extinction 48 year Risk Metric	Extinction 100 year Risk Metric	90% decline 24 year Risk Metric	90% decline 48 year Risk Metric	90% decline 100 year Risk Metric	NA Comments
		Hardy Creek	NA	0.045	0.061	1.046	NA	NA	NA	0.00	0.00	0.00	index data; var plot not very linear
		Crazy J	NA	0.146	0.031	1.158	NA	NA	NA	0.00	0.00	0.00	index data; var plot not very linear
		Hamilton	NA	-0.084	0.054	0.919	NA	NA	NA	0.40	0.86	1.00	index data; var plot not very linear
		Hamilton Springs	NA	0.106	0.590	1.112	NA	NA	NA	0.10	0.10	0.10	index data;
Steelhead	**Lower Columbia**	Clackamas Sum	9065	-0.345	0.011	0.708	0.05	1.00	1.00	1.00	1.00	1.00	
		Clackamas Win	3123	-0.310	0.004	0.734	0.02	1.00	1.00	1.00	1.00	1.00	var plot not very linear
		Coweeman Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not enough data
		Eagle Ck Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Green River Win	660	-0.102	0.212	0.903	0.06	0.40	0.86	0.53	0.79	0.96	
		Hood River Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Hood River Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Kalama Sum	18843	-0.300	0.015	0.741	0.00	1.00	1.00	1.00	1.00	1.00	
		Kalama River Win	6294	-0.122	0.008	0.885	0.00	0.00	1.00	0.93	1.00	1.00	var plot not very linear
		Lewis River Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Panther Ck Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not enough data
		Sandy Win	6012	-0.184	0.030	0.832	0.00	0.57	1.00	0.99	1.00	1.00	
		Toutle Win	3008	-0.133	0.001	0.875	0.00	0.00	1.00	1.00	1.00	1.00	var plot not very linear

Table A-15. continued							Extinction			90% decline			
Species	ESU	Stream	pop size est	μ	σ2	λ	24 year Risk Metric	48 year Risk Metric	100 year Risk Metric	24 year Risk Metric	48 year Risk Metric	100 year Risk Metric	NA Comments
		TroutCk Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not enough data
		Washougal Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Washougal River Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Wind Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not enough data
Steelhead	**Mid Columbia**	Beaver Creek Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Deschutes R Sum	70500	-0.291	0.017	0.748	0.00	1.00	1.00	1.00	1.00	1.00	
		Mill Ck Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Shitike Ck Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Warm Springs Nfh Sum	1031	-0.098	0.050	0.907	0.00	0.09	0.92	0.52	0.94	1.00	
		Eightmile Ck Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Ramsey Ck Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Fifteen Mile Ck Win	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No hatchery data
		Touchet R Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not enough data
		Umtilla R Sum	9809	-0.101	0.005	0.904	0.00	0.00	0.91	0.64	1.00	1.00	var plot not very linear
		Yakima R Sum	5561	0.008	0.012	1.008	0.00	0.00	0.00	0.00	0.00	0.00	
Steelhead	**Upper Columbia**	Upper Columbia River	7708	-0.413	0.035	0.662	0.87	1.00	1.00	1.00	1.00	1.00	

Table A-15. continued

Species	ESU	Stream	pop size est	μ	σ2	λ	Extinction 24 year Risk Metric	Extinction 48 year Risk Metric	Extinction 100 year Risk Metric	90% decline 24 year Risk Metric	90% decline 48 year Risk Metric	90% decline 100 year Risk Metric	NA Comments
Steelhead	**Snake R. Basin**	Snake River Sthead A-run	299161	-0.331	0.000	0.718	0.00	1.00	1.00	1.00	1.00	1.00	var plot not very linear
		Snake River Sthead B-run	100455	-0.320	0.023	0.726	0.00	1.00	1.00	1.00	1.00	1.00	
Steelhead	**Upper Williamette**	Mollala	2644	-0.203	0.109	0.816	0.04	0.83	1.00	0.94	1.00	1.00	
		N Santiam R	5653	-0.121	0.055	0.886	0.00	0.05	0.94	0.70	0.98	1.00	
		S Santiam	3730	-0.161	0.057	0.851	0.00	0.42	1.00	0.91	1.00	1.00	
		Calapooia	416	-0.075	0.188	0.928	0.04	0.29	0.74	0.41	0.67	0.88	

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A.6 References

Allen, R. L., and T. K. Meekin. 1973. An evaluation of the Priest Rapids chinook salmon spawning channel, 1963-1971. Washington Department of Fisheries, Technical Report 11:1-52, Olympia, Washington.

Barnhart, R. A. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)–steelhead. U.S. Fish and Wildlife Service, Biological Report 82(11.60).

Becker, D. C. 1970. Temperature, timing, and seaward migration of juvenile chinook salmon from the central Columbia River. Battelle Northwest Laboratories, AEC Research and Development Report, Richland, Washington.

Behnke, R. J. 1992. Native trout of western North America. American Fisheries Society Monograph 6, Bethesda, Maryland.

Bell, M. C. 1986. Fisheries handbook of engineering requirements and biological criteria. U.S. Army Corps of Engineers, North Pacific Division, Portland, Oregon.

Bevan, D., J. Harville, P. Bergman, T. Bjornn, J. Crutchfield, P. Klingeman, and J. Litchfield. 1994. Snake River Salmon Recovery Team: final recommendations to National Marine Fisheries Service. May.

Bjornn, T. C., D. R. Craddock, and D. R. Corley. 1968. Migration and survival of Redfish Lake, Idaho, sockeye salmon, *Oncorhynchus nerka*. Transactions of the American Fisheries Society 97:360-373.

Brown, L. 1999. Memo re: final Priest Rapids steelhead update (week of 10–16 October 1999), to B. Leland. Washington Department of Fish and Wildlife, Wenatchee, Washington. October 19.

BRT (Biological Review Team). 1998. Status review update for West Coast chinook salmon *(Oncorhynchus tshawytscha)* from Puget Sound, Lower Columbia River, Upper Willamette River, and UCR spring-run ESUs. National Marine Fisheries Service, West Coast Chinook Salmon BRT, Seattle, Washington.

BRWG (Biological Requirements Work Group). 1994. Progress report: analytical methods for determining requirements of listed Snake River salmon relative to survival and recovery. BRWG for *Idaho et al. v. NMFS et al.*, National Marine Fisheries Service. October 13.

Bugert, B. 1997. Biological Assessment, Mid-Columbia mainstem conservation plan—hatchery program. Draft. October 3.

Bugert, R., P. LaRiviere, D. Marbach, S. Martin, L. Ross, and D. Geist. 1990. Lower Snake River compensation plan salmon hatchery evaluation program. 1989 Annual Report to U.S. Fish and Wildlife Service (Cooperative Agreement 14-16-0001-89525).

Burgner, R. L. 1991. The life history of sockeye salmon (*Oncorhynchus nerka*). *In* C. Groot and L. Margolis, editors. Life history of Pacific salmon. University of British Columbia Press, Vancouver.

Burgner, R. L., J. T. Light, L. Margolis, T. Okazaki, A. Tautz, and S. Ito. 1992. Distribution and origins of steelhead trout (*Oncorhynchus mykiss*) in offshore waters of the North Pacific Ocean. International North Pacific Fish Commission Bulletin 51.

Busby, P. J., T. C. Wainwright, G. J. Bryant, L. J. Lierheimer, R. S. Waples, F. W. Waknitz, and I. V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington.

Cannamela, D. A. 1992. Potential impacts of releases of hatchery steelhead trout “smolts” on wild and natural juvenile chinook and sockeye salmon. Idaho Department of Fish and Game, White Paper, Boise.

Chilcote, M. W. 1998. Conservation status of steelhead in Oregon. Oregon Department of Fish and Wildlife, Portland.

Cooney, T. D. 2000. UCR steelhead and spring chinook salmon quantitative analysis report. Part 1: run reconstructions and preliminary assessment of extinction risk. National Marine Fisheries Service, Hydro Program, Technical Review Draft, Portland, Oregon. August 15.

Corps (U.S. Army Corps of Engineers). 1978. Bonneville lock and dam, Oregon and Washington, feasibility report and hydraulic model studies. Corps, Portland District, Portland, Oregon.

Corps (U.S. Army Corps of Engineers). 2000. Biological assessment of the effects of the Willamette River basin flood control project on species listed under the Endangered Species Act. Corps, Portland District, Portland, Oregon. April.

Cramer, S. P. 1990. The feasibility for reintroducing sockeye and coho salmon in the Grande Ronde River and coho and chum salmon in the Walla Walla River. Progress Report by S. P. Cramer and Associates, Inc., Gresham, Oregon, to Nez Perce Tribe, Umatilla Confederated Tribes, Warm Springs Confederated Tribes, and Oregon Department of Fish and Wildlife.

CRITFC (Columbia River Inter-Tribal Fish Commission). 1999. Biological assessment of incidental impacts on salmon species listed under the Endangered Species Act in treaty Indian mainstem and tributary fisheries in the Columbia River basin between January 1 and July 31, 2000. CRITFC to Bureau of Indian Affairs, Portland, Oregon.

Everest, F. H. 1973. Ecology and management of summer steelhead in the Rogue River. Oregon State Game Commission, Fisheries Research Report 7, Corvallis.

Evermann, B. W. 1895. A preliminary report upon salmon investigations in Idaho in 1894. U.S. Fish Commission Bulletin 15:253-284.

Fish, F. F., and M .G. Hanavan. 1948. A report on the Grand Coulee Fish Maintenance Project 1939-1947. U.S. Fish and Wildlife Service Special Scientific Report 55.

Fish Passage Center. 2000. Adult salmon passage counts. FPC (Fish Passage Center) Home. <*http:www.fpc.org/adlthist/prdadult.htm*> (accessed October 10).

Ford, M., P. Budy, C. Busack, D. Chapman, T. Cooney, T. Fisher, J. Geiselman, T. Hillman, J. Lukas, C. Peven, C. Toole, E. Weber, and P. Wilson. 1999. UCR steelhead and spring chinook salmon population structure and biological requirements. National Marine Fisheries Service, Northwest Fisheries Science Center, Upper Columba River Steelhead and Spring Chinook Salmon Biological Requirements Committee, Draft Report, Seattle, Washington. November 23.

Fulton, L. A. 1968. Spawning areas and abundance of chinook salmon, *Oncorhynchus tshawytscha*, in the Columbia River basin—past and present. U.S. Fish and Wildlife Service, Special Scientific Report—Fisheries 571:26.

Fulton, L. A. 1970. Spawning areas and abundance of steelhead trout and coho, sockeye, and chum salmon in the Columbia River basin—past and present. Special Scientific Report—Fisheries 618.

Giger, R. D. 1973. Streamflow requirements of salmonids. Oregon Wildlife Commission, Final Report (Project AFS-62-1), Portland.

Gilbert, C. H. 1912. Age at maturity of Pacific coast salmon of the genus *Oncorhynchus*. Bulletin of the U.S. Fish Commission 32:57-70.

Hall-Griswold, J. A., and C. E. Petrosky. 1998. Idaho habitat/natural production monitoring. Part 1: general monitoring subproject. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Annual Report 1996 (Project 91-73), Portland, Oregon.

Hart, J. L. 1973. Pacific fisheries of Canada. Fisheries Research Board of Canada Bulletin 180:199-221.

Hartt, A. C., and M. B. Dell. 1986. Early oceanic migrations and growth of juvenile Pacific salmon and steelhead trout. International North Pacific Fisheries Commission Bulletin 46:1-105.

Healey, M. C. 1983. Coastwide distribution and ocean migration patterns of stream- and ocean-type chinook salmon, *Oncorhynchus tshawytscha*. Canadian Field-Naturalist 97:427-433.

Healey, M. C. 1986. Optimum size and age at maturity in Pacific salmon and effects of size-selective fisheries. Canadian Special Publications Fisheries and Aquatic Sciences 89:39-52.

Healey, M. C. 1991. Life history of chinook salmon (*Oncorhynchus tshawytscha*). Pages 311-393 *in* Groot, C. and L. Margolis, editors. Pacific salmon life histories. University of British Columbia Press, Vancouver, B.C.

Howell, P., K. Jones, D. Scarnecchia, L. LaVoy, W. Knedra, and D. Orrmann. 1985. Stock assessment of Columbia River anadromous salmonids, volume 1. Final Report to Bonneville Power Administration, Portland, Oregon (Project 83-335).

Howell, P., J. Hutchinson, and R. Hooton. 1988. McKenzie subbasin fish management plan. Oregon Department of Fish and Wildlife, Portland, Oregon.

Jackson, P. L. 1993. Climate. Pages 48-57 *in* P. L. Jackson and A. J. Kimerling, editors. Atlas of the Pacific Northwest. Oregon State University Press, Corvallis.

Kostow, K, editor. 1995. Biennial report on the status of wild fish in Oregon. Oregon Department of Fish and Wildlife, Internal Report, Portland, Oregon.

Lichatowich, J. A., L. G. Gilbertson, and L. E. Mobrand. 1993. A concise summary of Snake River chinook production. Mobrand Biometrics, Inc., Vashon Island, Washington, to Snake River Salmon Recovery Team.

Lindsay, R. B., R. K. Schroeder, and K. R. Kenaston 1998. Spring chinook salmon in the Willamette and Sandy rivers. Oregon Department of Fish and Wildlife, Annual Progress Report F-163-R-03, Portland, Oregon.

Marmorek, D. R., and C. N. Peters, editors. 1998. Plan for analyzing and testing hypotheses (PATH): preliminary decision analysis report on Snake River spring/summer chinook. ESSA Technologies Ltd., Vancouver, B.C.

Marshall, A. R., C. Smith, R. Brix, W. Dammers, J. Hymer, and L. LaVoy. 1995. Genetic diversity units and major ancestral lineages for chinook salmon in Washington. Pages 111-173 *in* C. Busack and J. B. Shaklee, editors. Genetic diversity units and major ancestral lineages of salmonid fishes in Washington. Washington Department of Fish and Wildlife Technical Report RAD 95-02.

Matthews, G. M., and R. S. Waples. 1991. Status review for Snake River spring and summer chinook salmon. National Marine Fisheries Service, Northwest Fisheries Science Center, NOAA Technical Memorandum NMFS F/NWC-200, Seattle, Washington.

Mattson, C. R. 1962. Early life history of Willamette River spring chinook salmon. Fish Commission of Oregon, Clackamas.

McClure, M., B. Sanderson, E. Holmes, C. Jordan, P. Kareiva, and P. Levin. 2000a. A standardized quantitative analysis of the risks faced by salmonids in the Columbia River basin. National Marine Fisheries Service, Northwest Fisheries Science Center, Cumulative Risk Initiative, Draft Report, Seattle, Washington. April 7.

McClure, M., B. Sanderson, E. Holmes, C. Jordan, P. Kareiva, and P. Levin. 2000b. Revised Appendix B of standardized quantitative analysis of the risks faced by salmonids in the Columbia River basin. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington. September.

McClure, M. M., B. L. Sanderson, E. E. Holmes, and C. E. Jordan. 2000c. A large-scale, multi-species risk assessment: anadromous salmonids in the Columbia River basin. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington. Submitted to Ecological Applications.

McElhany, P., M. Ruckelshaus, M. J. Ford, T. Wainwright, and E. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. National Marine Fisheries Service, Northwest Fisheries Science Center, Draft Report, Seattle, Washington. January 6.

McPhail, J. D., and C. C. Lindsey. 1970. Freshwater fishes of Northwestern Canada and Alaska. Bulletin of the Fisheries Research Board of Canada 173:381.

Mealy, S. P. 1997. Letter re: state of Idaho's comments on the proposed listing of Snake River steelhead for protection under the Federal Endangered Species Act. Idaho Department of Fish and Game. February 11.

Meehan, W. R., and T. C. Bjornn. 1991. Salmonid distributions and life histories. Pages 47-82 *in* W. R. Meehan, editor. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19, Bethesda, Maryland.

Miller, R. J., and E .L. Brannon. 1982. The origin and development of life-history patterns in Pacific salmon. *In* E. L. Brannon and E. O. Salo, editors. Proceedings of the salmon and trout migratory behavior symposium. University of Washington Press, Seattle.

Mullan, J. W., A. Rockhold, and C. R. Chrisman. 1992a. Life histories and precocity of chinook salmon in the mid-Columbia River. Progressive Fish-Culturist 54:25-28.

Mullan, J. W., K. R. Williams, G. Rhodus, T. W. Hillman, and J. D. McIntyre. 1992b. Production and habitat of salmonids in mid-Columbia River tributary streams. U.S. Fish and Wildlife Service Monograph 1.

Myers, J. M., R. G. Kope, G. J. Bryant, L. J. Lierheimer, R. S. Waples, R. W. Waknitz, T. C. Wainwright, W. S. Grant, K. Neely, and S. T. Lindley. 1998. Status review of chinook salmon from Washington, Idaho, Oregon, and California. National Marine Fisheries Service, Northwest Fisheries Science Center, NOAA Technical Memorandum NMFS-NWFSC-35, Seattle, Washington.

Nicholas, J. 1995. Status of Willamette spring-run chinook salmon relative to Federal Endangered Species Act. Oregon Department of Fish and Wildlife to National Marine Fisheries Service, Portland, Oregon.

Nicholas, J .W., and D. G. Hankin. 1988. Chinook salmon populations in Oregon coastal river basin: description of life histories and assessment of recent trends in run strengths. Oregon Department of Fish and Wildlife, Information Report 88-1, Corvallis, Oregon.

Nickelson, T. E., J. W. Nicholas, A. M. McGie, R. B. Lindsay, D. L. Bottom, R. J. Kaiser, and S. E. Jacobs. 1992. Status of anadromous salmonids in Oregon coastal basins. Oregon Department of Fish and Wildlife, Research and Development Section, Corvallis, and Ocean Salmon Management, Newport, Oregon.

NMFS (National Marine Fisheries Service). 1991a. Factors for decline: a supplement to the notice of determination for Snake River fall chinook salmon under the Endangered Species Act. NMFS, Protected Resources Division, Portland, Oregon. June.

NMFS (National Marine Fisheries Service). 1991b. Factors for decline: a supplement to the notice of determination for Snake River spring/summer chinook salmon under the Endangered Species Act. NMFS, Protected Resources Division, Portland, Oregon.

NMFS (National Marine Fisheries Service). 1995. Proposed recovery plan for Snake River salmon. NMFS, Protected Resources Division, Portland, Oregon.

NMFS (National Marine Fisheries Service). 1999a. Biological opinion on artificial propagation in the Columbia River basin—incidental take of listed salmon and steelhead from Federal and non-Federal hatchery programs that collect, rear, and release unlisted fish species. NMFS, Endangered Species Act Section 7 consultation. March 29.

NMFS (National Marine Fisheries Service). 1999b. Biological opinion and incidental take statement on 1999 Treaty Indian and non-Indian fall season fisheries in the Columbia River basin. NMFS, Endangered Species Act Section 7 consultation. July 30.

Olsen, E., P. Pierce, M. McLean, and K. Hatch. 1992. Stock summary reports for Columbia River anadromous salmonids. Volume 1: Oregon. U.S. Department of Energy, Bonneville Power Administration, Portland, Oregon (Project 88-108).

ODFW (Oregon Department of Fish and Wildlife). 1998a. Briefing paper—Lower Columbia River chinook ESU. ODFW, Portland, Oregon. October 13.

ODFW (Oregon Department of Fish and Wildlife). 1998b. Oregon wild fish management policy. ODFW, Portland, Oregon.

ODFW (Oregon Department of Fish and Wildlife). 1998c. Spring chinook chapters—Willamette basin fish management plan. ODFW, Portland, Oregon. March.

ODFW. 2000. Willamette Falls spring chinook salmon counts. ODFW website. <*http://www.dfw.state.or.us/ODFWhtml/InfoCntrFish/Willam.html#graphs*> October 10.

ODFW (Oregon Department of Fish and Wildlife) and WDFW (Washington Department of Fish and Wildlife). 1998. Status report, Columbia River fish runs and fisheries, 1938-1997. ODFW, Portland, Oregon, and WDFW, Olympia, Washington.

ODFW (Oregon Department of Fish and Wildlife) and WDFW (Washington Department of Fish and Wildlife). 1999. Status report, Columbia River fish runs and fisheries, 1938-1998. ODFW, Portland, Oregon, and WDFW, Olympia, Washington.

Pearcy, W. G. 1992. Ocean ecology of North Pacific salmonids. University of Washington Press, Seattle.

Pearcy, W. G., R. D. Brodeur, and J. P. Fisher. 1990. Distribution and biology of juvenile cutthroat *Oncorhynchus clarki clarki* and steelhead *O. mykiss* in coastal waters off Oregon and Washington. Fisheries Bulletin 88:697-711.

Peery, C. A., and T. C. Bjornn. 1991. Examination of the extent and factors affecting downstream emigration of chinook salmon fry from spawning grounds in the upper Salmon River. Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho, Unpublished Report, Moscow.

Peters, C. N, D. R. Marmorek, and I. Parnell, editors. 1999. Plan for analyzing and testing hypotheses (PATH) decision analysis report for Snake River fall chinook. ESSA Technologies Ltd., Vancouver, B.C.

Pettit, R. 1998. Escapement estimates for spring chinook in Washington tributaries below Bonneville Dam, 1980-1998. Washington Department of Fish and Wildlife, Columbia River Progress Report 98-13, Olympia.

PFMC (Pacific Fishery Management Council). 1996. Review of the 1995 ocean salmon fisheries. PFMC, Portland, Oregon.

PFMC (Pacific Fishery Management Council). 2000. Analysis of proposed regulatory options for 2000 ocean salmon fisheries. PFMC, Preseason Report II, Portland, Oregon.

Phelps, S. R., S. A. Leider, P. L. Hulett, B. M. Baker, and T. Johnson. 1997. Genetic analyses of Washington steelhead: preliminary results incorporating 36 new collections from 1995 and 1996. Washington Department of Fish and Wildlife, Olympia. February.

Pitcher, T. J. 1986. Functions of shoaling in teleosts. Pages 294-337 *in* Fisher, T. J., editor. The behavior of teleost fishes. Johns Hopkins University Press, Baltimore, Maryland.

Randall, R. G., M. C. Healey, and J. B. Dempson. 1987. Variability in length of freshwater residence of salmon, trout, and char. *In* M. J. Dodswell et al., editors. Common strategies of anadromous and catadromous fishes. American Fisheries Society Symposium 1:27-41.

Reimers, P. E., and R. E. Loeffel. 1967. The length of residence of juvenile fall chinook salmon in selected Columbia River tributaries. Fish Commission of Oregon 13:5-19.

Ricker, W. E. 1972. Hereditary and environmental factors affecting certain salmonid populations. *In* R. C. Simon and P. A. Larkin, editors. The stock concept in Pacific salmon. MacMillan Lectures in Fisheries, University of British Columbia, Vancouver, B.C.

Salo, E. O. 1991. Life history of chum salmon, *Oncorhynchus keta*. Pages 231-309 *in* C. Groot and L. Margolis, editors. Pacific salmon life histories. University of British Columbia Press, Vancouver, B.C.

Schroeder, R. K., K. R. Kenaston, and R. B. Lindsay. 1999. Spring chinook salmon in the Willamette and Sandy rivers. Oregon Department of Fish and Wildlife, Annual Progress Report F-163-R-04, Portland, Oregon.

StreamNet. 2000. Dam/weir counts for SR sockeye salmon at Redfish Lake. Pacific States Marine Fisheries Commission. <*http://www.streamnet.org*> (accessed November 9).

TAC (Technical Advisory Committee). 1997. All species review, 1996—summer steelhead: Columbia River fish management plan. TAC for *U.S. v. Oregon*. August 4 (tables 8-11 updated).

TAC (Technical Advisory Committee). 1999. Minutes of meeting May 4-5, 1999. TAC for *U.S. v. Oregon*.

Taylor, E. B. 1991. A review of local adaptation in Salmonidae, with particular reference to Pacific and Atlantic salmon. Aquaculture 98:185-207.

Toner, R. C. 1960. A study of some of the factors associated with the reestablishment of blueback salmon (*Oncorhynchus nerka*) into the upper Wallowa River system. Appendix A *in* R. N. Thompson and J. B. Haas, editors. Environmental survey report pertaining to salmon and steelhead in certain rivers of eastern Oregon and the Willamette River and its tributaries. Part 1: survey reports of eastern Oregon rivers. Fish Commission of Oregon, Clackamas.

Utter, F., G. Milner, G. Stahl, and D. Teel. 1989. Genetic population structure of chinook salmon (*Oncorhynchus tshawytscha*) in the Pacific Northwest. Fisheries Bulletin 87:239-264.

A, R. S., O. W. Johnson, P. B. Aebersold, C. K. Shiflett, D. M. VanDoornik, D. J. Teel, and A. E. Cook. 1993. A genetic monitoring and evaluation program for supplemented populations of salmon and steelhead in the Snake River Basin. Annual report of National Marine Fisheries Service, Northwest Fisheries Service, Seattle, Washington, to Bonneville Power Administration, Portland, Oregon.

Waples, R. S., O. W. Johnson, and R. P. Jones, Jr. 1991a. Status review for Snake River sockeye salmon. National Marine Fisheries Service, Northwest Fisheries Science Center, NOAA Technical Memorandum NMFS F/NWC-195, Seattle, Washington.

Waples, R. S., R. P. Jones, B. R. Beckman, and G. A. Swan. 1991b. Status review for Snake River fall chinook salmon. National Marine Fisheries Service, Northwest Fisheries Science Center, NOAA Technical Memorandum NMFS F/NWC-201, Seattle, Washington.

WDF (Washington Department of Fisheries). 1951. Lower Columbia River fisheries development program. WDF, Planning Report, Preliminary Draft, Olympia, Washington. August.

WDF (Washington Department of Fisheries), WDW (Washington Department of Wildlife), and WWTIT (Western Washington Treaty Indian Tribes). 1993a. Columbia River stocks. Appendix 3 *in* Washington State salmon and steelhead stock inventory (SASSI). WDF, WDW, and WWTIT, Olympia, Washington.

WDF (Washington Department of Fisheries), WDW (Washington Department of Wildlife), and WWTIT (Western Washington Treaty Indian Tribes). 1993b. Washington state salmon and steelhead stock inventory (SASSI), 1992. WDF, WDW, and WWTIT, Olympia, Washington.

WDFW (Washington Department of Fish and Wildlife). 1997. Preliminary stock status update for steelhead in the Lower Columbia. WDFW, Olympia, Washington.

Welsh, T .L. 1991. Stanley Basin sockeye salmon lakes, upper Salmon River drainage, Idaho. Unpublished report to University of Idaho Aquaculture Institute.

Withler, I. L. 1966. Variability in life history characteristics of steelhead trout (*Salmo gairdneri*) along the Pacific coast of North America. Journal of the Fisheries Research Board of Canada 23:365-393.

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Appendix B
Objectives of the Basinwide Salmon Recovery Strategy and Federal Agency FCRPS Commitments and Interim Recovery Numbers

Table of Contents

A. Overview of Appendix B

Appendix B outlines the objectives of the Basin-wide Salmon Recovery Strategy (Recovery Strategy) and major federal agency commitments to support conservation of non-federal habitat and federal land management initiatives in Columbia River tributaries, mainstem, and estuary under the FCRPS biological opinion.

This appendix also includes interim abundance and productivity targets for ESA listed salmon and steelhead in the Interior Columbia Basin. These interim targets are only a starting point. NOAA Fisheries will replace these targets with scientifically more rigorous and comprehensive recovery goals using viability criteria developed through the Interior Columbia Technical Recovery Team (TRT) process that commenced in October, 2001.

B. Basinwide Salmon Recovery Strategy Objectives

- Biological Objectives

  - Maintain and improve upon the current distribution of fish and aquatic species, and halt declining population trends within 5-10 years.
  - Establish increasing trends in naturally-sustained fish populations in each subregion accessible to the fish and for each ESU within 25 years.
  - Restore distribution of fish and other aquatic species within their native range within 25 years (where feasible).
  - Conserve genetic diversity and allow natural patterns of genetic exchange to persist.

- **Ecological Objectives**

  - Prevent further degradation of tributary, mainstem and estuary habitat conditions and water quality.
  - Protect existing high quality habitats.
  - Restore habitats on a priority basis.

- **Water Quality Objective**

  - In the long term, attain state and tribal water quality standards in all critical habitats in the Columbia River and Snake River basins.

C. Federal Agency Commitments

The federal agencies include: U. S. Forest Service (Forest Service), Bureau of Land Management (BLM), Bonneville Power Administration (BPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), Environmental Protection Agency (EPA), Bureau of Indian Affairs (BIA), Army Corps of Engineers (COE), and Bureau of Reclamation (BOR)(and, if appropriate, the Natural Resource Conservation Service (NRCS), the Farm Service Administration (FSA) and U. S. Geological Survey (USGS)).

In the short term, federal land will be managed by current programs that protect important aquatic habitats. On the east side of the Cascades the Forest Service and BLM manage salmonid habitat according to PACFISH/INFISH, and on the west side of the Cascades the Forest Service and BLM manage salmonid habitat under the Northwest Forest Plan. PACFISH/INFISH and the Northwest Forest Plan aim to protect areas that contribute to salmonid recovery and improve riparian habitat and water quality throughout the Basin. To meet these objectives, the Northwest Forest Plan and PACFISH/INFISH:

- Establish watershed and riparian goals to maintain or restore all fish habitat

- Establish aquatic and riparian habitat management objectives

- Delineate riparian management areas

- Provide specific standards and guidelines for timber harvest, grazing, fire suppression and
mining in riparian areas

- Provide a mechanism to delineate a system of key watersheds to protect and restore important fish habitats

- Use watershed analyses and subbasin reviews to set priorities and provide guidance on priorities for watershed restoration

- Provide general guidance on implementation and effectiveness monitoring

- Emphasize habitat restoration through such activities as closing and rehabilitating roads, replacing culverts, changing grazing and logging practices, and replanting native vegetation along streams and rivers.

In the longer term, management on the east side of the Cascades will be guided by the Interior Columbia Basin Ecosystem management Project (ICBEMP) as that strategy is put in place.

The Forest Service and BLM have made the following commitments to ensure that federal land management under ICBEMP will help protect and recover listed fish (these principles may be adjusted by the ICBEMP NEPA process and Record of Decision):

- Retain or recharter the Interagency Implementation Team (IIT) (senior staff from BLM, Forest Service, USFWS, and NMFS) or a similar interagency team to aid in the transition from interim aquatic management strategies and products developed by the IIT to the long term ICBEMP direction.

- Strategically focus Forest Service and BLM scarce restoration resources using broad scale aquatic/riparian restoration priorities to first secure federally-owned areas of high aquatic integrity and second, restore out from that core, rebuilding connected habitats that support spawning and rearing.

- Ensure that land managers consider the broad landscape context of site-specific decisions on management activities by requiring a hierarchically-linked approach to analysis at different geographic scales. This is important to ensuring that the type, location and sequencing of activities within a watershed are appropriate and done in the context of cumulative effects and broad scale issues, risks, opportunities and conditions.

- Cooperate with similar basin planning processes sponsored by the Northwest Power Planning Council, BPA and other federal agencies, states and tribes to identify habitat restoration opportunities and priorities. Integrate information from these processes into ICBEMP subbasin review when appropriate.

- Consult with NMFS and USFWS on land management plans and actions that may affect listed fish species following the Streamlined Consultation Procedures for Section 7 of the Endangered Species Act, July 1999.

- Collaborate early and frequently with states, tribes, local governments and advisory councils in land management analyses and decisions.

- Cooperate with the other federal agencies (in particular NMFS and USFWS), states and tribes in the development of recovery plans and conservation strategies for listed and proposed fish species. Require that land management plans and activities be consistent with approved recovery plans and conservation strategies.

- Collaborate with other federal agencies, states, tribes and local watershed groups in the development of watershed plans for both federal and non federal lands and cooperate in priority restoration projects by providing technical assistance, dissemination of information and allocation of staff, equipment and funds.

- Share information, technology and expertise, and pool resources, in order to make and implement better-informed decisions related to ecosystems and adaptive management across jurisdictional boundaries.

- Collaborate with other federal agencies, states and tribes to improve integrated application of agency budgets to maximize efficient use of funds towards high priority restoration efforts on both federal and non-federal lands.

- Collaborate with other federal agencies, states and tribes in monitoring efforts to assess if habitat performance measures and standards are being met.

- Require that land management decisions be made as part of an ongoing process of planning, implementation, monitoring and evaluation. Incorporate new knowledge into management through adaptive management.

- Enhance the existing organizational structure with an interagency basinwide coordinating group and a number of sub-regional interagency coordinating committees. These coordinating groups and committees will ensure the implementation of ecosystem-based management across federal agencies' administrative boundaries, resolve implementation issues, be responsible for data management and monitoring, and incorporate new information through adaptive management.

Bureau of Reclamation (BOR)

Tributary

1. In priority watersheds, address all flow, passage and diversion problems over 10 years by restoring tributary flows, screening and combining water diversions, reduce passage obstructions.

Priority subbasins, organized by ESU are:

Upper Columbia Spring Chinook and Steelhead:
    Methow
    Entiat
    Wenatchee

Snake River Fall and Spring/Summer Chinook and Steelhead:
    Lemhi
    Upper Salmon
    Middle Fork Clearwater
    Little Salmon

Mid-Columbia Chinook, and Steelhead:
    North Fork John Day
    Upper John Day
    Middle Fork John Day

Lower Columbia Chinook, Steelhead and Chum:
    Lewis
    Upper Cowlitz
    Willamette-Clackamas

Upper Willamette Chinook and Steelhead:
    Clackamas
    North Santiam

McKenzie

Corresponding 2000 FCRPS RPA Action- 149

2. Federal agencies will develop an initial set of performance measures based on four key habitat factors: instream flows; amount and timing of sediment inputs to streams; riparian conditions that determine water quality, bank integrity, wood input and maintenance of channel complexity and habitat access. Changes in these attributes can be measured at the reach or the watershed level and aggregated to larger spatial scales to evaluate progress at the subbasin or basin level.

Mainstem

1. Study the feasibility (including both biological benefits and ecological risks) of habitat modification to improve spawning conditions for chum salmon in the Ives Island area.

The objectives of the study will be to determine whether it would be beneficial to increase the frequency of access to spawning habitat or the areal extent of spawning habitat by means other than flow augmentation. The feasibility study will evaluate actions to alter the hydraulic control points that limit flow in the Ives Island area to provide the same areal extent and quality of sustainable spawning habitat (including characteristics such as upwelling through the gravels currently present at the site) at lower levels of Bonneville discharge; reconstruct spawning channels to increase the extent of habitat available at a given level of Bonneville discharge; and maintain hydraulic connections between tributary habitats and the mainstem Columbia River to allow entry for adults and emergence channels for juveniles.

Corresponding 2000 FCRPS RPA Action- 156

Bonneville Power Administration (BPA)

Tributary

1. Restore tributary flows through a water brokerage. Beginning in 2001, BPA is to fund a project to experiment with innovative ways to increase tributary flows by, for example, establishing a water brokerage to increase flows. The project will also develop a plan for a pollution bank through which water quality credits could be exchanged in markets. BPA also will fund the development of a methodology for ascertaining instream flows that meet ESA requirements.

Corresponding 2000 FCRPS RPA Action- 151

2. Support development of 303(d) lists and Clean Water Act TMDLs (total maximum daily load). BPA and other Action Agencies (if it is within their jurisdiction) are to support the development of state or tribal 303(d) lists. Additionally, they are to provide funding to implement measures with direct ESA benefit in approved TMDLs and consult with state and tribal water quality entities to determine how water quality efforts can complement each other and avoid duplication.

Corresponding 2000 FCRPS RPA Action- 152

3. Fund efforts to protect currently productive non-Federal habitat in Subbasins with listed salmon and steelhead. BPA is to place particular emphasis on protecting habitat that is at risk of being degraded, in accordance with criteria and priorities developed with NMFS.

Corresponding 2000 FCRPS RPA Action- 150

4. Protect up to100 stream miles per year. BPA, working with agricultural incentive programs such as the Conservation Reserve Enhancement Program, will fund permanent or long-term protection for 100 miles of riparian buffers per year.

Corresponding 2000 FCRPS RPA Action- 153

5. Support Subbasin and Watershed Assessment and Planning. BPA and the other Federal agencies will work with the Northwest Power Planning Council to develop and update subbasin assessments and plans. Complete preliminary subbasin assessments by early 2001, preliminary subbasin plans by 2002.

Corresponding 2000 FCRPS RPA Action- 154

6. Federal agencies will develop an initial set of performance measures based on four key habitat factors: instream flows; amount and timing of sediment inputs to streams; riparian conditions that determine water quality, bank integrity, wood input and maintenance of channel complexity and habitat access. Changes in these attributes can be measured at the reach or the watershed level and aggregated to larger spatial scales to evaluate progress at the subbasin or basin level.

Mainstem

1. As lead agency: 1) develop a baseline data set; 2) develop and implement a habitat improvement plan that, insofar as possible, mimics the range and diversity of historic habitat conditions; and 3) develop and implement a rigorous monitoring and evaluation action plan that may lead to changes in the mainstem habitat program.

Corresponding 2000 FCRPS RPA Action- 155

2. Study the feasibility (including both biological benefits and ecological risks) of habitat modification to improve spawning conditions for chum salmon in the Ives Island area.

The objectives of the study will be to determine whether it would be beneficial to increase the frequency of access to spawning habitat or the areal extent of spawning habitat by means other than flow augmentation. The feasibility study will evaluate actions to alter the hydraulic control points that limit flow in the Ives Island area to provide the same areal extent and quality of sustainable spawning habitat (including characteristics such as upwelling through the gravels currently present at the site) at lower levels of Bonneville discharge; reconstruct spawning channels to increase the extent of habitat available at a given level of Bonneville discharge; and maintain hydraulic connections between tributary habitats and the mainstem Columbia River to allow entry for adults and emergence channels for juveniles.

Corresponding 2000 FCRPS RPA Action- 156

3. BPA will fund actions to improve and restore tributary and mainstem habitat for CR chum salmon in the reach between The Dalles Dam and the mouth of the Columbia River.

The purpose of this action is to compensate for effects of FCRPS water management in the Ives Island area, which appreciably diminish the value of critical spawning habitat for the survival and recovery of CR chum salmon. The FCRPS has been a relatively important factor for decline of this ESU. Bonneville and The Dalles dams limit access to potential spawning habitat further upstream and Bonneville Reservoir drowned known historical habitat in Bonneville pool. Spawning is currently known in only two areas: the Grays River system in the Columbia River estuary and the Hardy/Hamilton creeks/Ives Island complex, downstream of Bonneville Dam.

Although most of the existing subbasin populations and the ESU as a whole are on a slightly positive growth trajectory (ESU-level lambda = 1.035), RPA water management operations will continue to limit the areal extent of spawning habitat in Bonneville pool and the Ives Island complex in most water years. Therefore, BPA will 1) fund surveys of existing and potential tributary and mainstem habitat in the Columbia River between The Dalles Dam and the mouth of the Columbia River for suitable protection and restoration projects, 2) develop and implement an effective habitat improvement plan, 3) protect, via purchase, easement, or other means, existing or potential spawning habitat in this reach and adjacent tributaries (i.e., protect, restore, and/or create potentially productive spawning areas). The overall goal of this effort will be to ensure the survival and recovery of CR chum salmon by ensuring the availability of diverse, productive spawning habitats over a wide range of water years.

Corresponding 2000 FCRPS RPA Action- 157

Estuary

1. BPA and the COE will seek funding and develop an action plan to rapidly inventory estuarine habitat, model physical and biological features of the historical lower river and estuary, identify limiting biological and physical factors in the estuary, identify impacts of the FCRPS system on habitat and listed salmon in the estuary relative to other factors, and develop criteria for estuarine habitat restoration.

RPA 158

2. BPA and the COE, working with the Lower Columbia River Estuary Program (LCREP) and NMFS, shall develop a plan addressing the habitat needs of salmon and steelhead in the estuary.

Specific plans will be developed for salmon and steelhead habitat protection and enhancement. These plans should contain clear goals for listed salmon conservation in the estuary, identify habitats with the characteristics and diversity to support salmon productivity, identify potential performance measures, identify flow requirements to support estuarine habitat requirements for salmon, and develop a program of research, monitoring, and evaluation. The plans should be completed by 2003.

Corresponding 2000 FCRPS RPA Action- 159

3. The COE and BPA, working with LCREP, shall develop and implement an estuary restoration program with a goal of protecting and enhancing 10,000 acres of tidal wetlands and other key habitats over 10 years, beginning in 2001, to rebuild productivity for listed populations in the lower 46 river miles of the Columbia River.

Much of the complexity of the estuary's historic shallow-water habitat and much of the estuary's saltwater wetlands have been lost due to the effects of local, navigational, and hydropower development. LCREP proposes a 10-year program to protect and enhance high-quality habitat on both sides of the river to support salmon rebuilding. A high priority should be put on tidal wetlands and other key habitats to rebuild productivity in the lower 46 river miles. Federal agencies will provide technical and financial support for this program and for efforts to implement on-the-ground activities identified in planning.

As more information is gained from inventory and analytical work, the 10,000-acre goal may be modified to ensure that habitats that are determined to be important to the survival and recovery of anadromous fish are addressed. Examples of acceptable estuary habitat improvement work include the following:

- Acquiring rights to diked lands
- Breaching levees
- Improving wetlands and aquatic plant communities
- Enhancing moist soil and wooded wetland via better management of river flows
- Reestablishing flow patterns that have been altered by causeways
- Supplementing the nutrient base by importing nutrient-rich sediments and large woody debris into the estuary
- Modifying abundance and distribution of predators by altering their habitat
- Creating wetland habitats in sand flats between the north and south channels
- Creating shallow channels in inter-tidal areas
- Enhancing connections between lakes, sloughs, side channels, and the main channel

Corresponding 2000 FCRPS RPA Action- 160

4. BPA and NMFS will develop a conceptual model of the relationship between estuarine conditions and salmon population structure and resilience. The model will highlight the relationship among hydropower, water management, estuarine conditions, and fish response. The work will enable the agencies to identify information gaps that have to be addressed to develop recommendations for FCRPS management and operations.

Corresponding 2000 FCRPS RPA Action- 162

5. The Federal agencies will develop performance measures for the actions taken in the estuary.

National Marine Fisheries Service (NMFS)

Tributary

1. Restore tributary flows through a water brokerage. NMFS is a co-lead agency with BPA in this commitment. NMFS and BPA will jointly decide whether to continue to fund this project beyond the $5 million per year base in years 2-5. NMFS and BPA will also explore the possibility of integrating this project into the Northwest Power Planning Council's land and water trust fund.

Corresponding 2000 FCRPS RPA Action- 151

2. Protect currently productive habitat. Develop, with BPA, criteria and priorities for efforts to protect currently productive non-federal habitat.

3. Establish recovery objectives, de-listing criteria and recovery measures for the Upper Willamette, Lower Columbia, and Interior Columbia.

4. Federal agencies will develop an initial set of performance measures based on four key habitat factors: instream flows; amount and timing of sediment inputs to streams; riparian conditions that determine water quality, bank integrity, wood input and maintenance of channel complexity and habitat access. Changes in these attributes can be measured at the reach or the watershed level and aggregated to larger spatial scales to evaluate progress at the subbasin or basin level.

Estuary

1. NMFS, working with the BPA, the COE, and the Lower Columbia River Estuary Program (LCREP), shall develop a plan addressing the habitat needs of salmon and steelhead in the estuary.

Specific plans will be developed for salmon and steelhead habitat protection and enhancement. These plans should contain clear goals for listed salmon conservation in the estuary, identify habitats with the characteristics and diversity to support salmon productivity, identify potential performance measures, identify flow requirements to support estuarine habitat requirements for salmon, and develop a program of research, monitoring, and evaluation. The plans should be completed by 2003.

2. Support a Lower Columbia River Estuary Program (LCREP) designated entity to build a major information management and public education initiative through the LCREP to focus on endangered species, habitat loss and restoration, biological diversity and human activities that impact the river.

3. BPA and NMFS will develop a conceptual model of the relationship between estuarine conditions and salmon population structure and resilience. The model will highlight the relationship among hydropower, water management, estuarine conditions, and fish response. The work will enable the agencies to identify information gaps that have to be addressed to develop recommendations for FCRPS management and operations.

4. The Federal agencies will develop performance measures for the actions taken in the estuary.

Environmental Protection Agency (EPA)

Tributary

1. Integration of the Clean Water Act (CWA) TMDL (total maximum daily load) process and the Endangered Species Act (ESA). EPA, NMFS, U.S. Fish and Wildlife Service and BPA will select pilot projects on the basis of nominations from Oregon, Washington and Idaho.   These pilot projects would have the following objectives:

- Integrate CWA TMDL processes and ESA to avoid duplication of effort
- Develop one set of watershed goals that meet CWA and ESA requirements
- Provide CWA and ESA assurances to the extent allowable by law

Three TMDLs and implementation plans/HCPs will be completed over three years.

2. Federal agencies will develop an initial set of performance measures based on four key habitat factors: instream flows; amount and timing of sediment inputs to streams; riparian conditions that determine water quality, bank integrity, wood input and maintenance of channel complexity and habitat access.   Changes in these attributes can be measured at the reach or the watershed level and aggregated to larger spatial scales to evaluate progress at the subbasin or basin level.

Farm Service Agency (FSA)

Tributary

1. Protect up to100 stream miles per year. BPA is to work with agricultural incentive programs such as the Conservation Reserve Enhancement Program, will fund long-term protection for 100 miles of riparian buffers per year.

U.S. Fish and Wildlife Service

Tributary

1. Integration of the Clean Water Act (CWA) TMDL (total maximum daily load) process and

the Endangered Species Act (ESA). EPA, NMFS, U.S. Fish and Wildlife Service and BPA will select pilot projects on the basis of nominations from Oregon, Washington and Idaho. These pilot projects would have the following objectives:

- Integrate CWA TMDL processes and ESA to avoid duplication of effort
- Develop one set of watershed goals that meet CWA and ESA requirements
- Provide CWA and ESA assurances to the extent allowable by law

Three TMDLs and implementation plans/HCPs will be completed over three years.

2. Federal agencies will develop an initial set of performance measures based on four key habitat factors: instream flows; amount and timing of sediment inputs to streams; riparian conditions that determine water quality, bank integrity, wood input and maintenance of channel complexity and habitat access. Changes in these attributes can be measured at the reach or the watershed level and aggregated to larger spatial scales to evaluate progress at the subbasin or basin level.

Estuary

1. The COE, with the U.S. Fish and Wildlife Service will significantly reduce Caspian tern and cormorant predation on salmonids. In the short term, it will preclude Caspian tern nesting on Rice Island. For the long term, it will disperse the tern population to its range of historic nesting in Pacific states.

2. Support a Lower Columbia River Estuary Program (LCREP) designated entity to build a major information management and public education initiative through the LCREP to focus on endangered species, habitat loss and restoration, biological diversity and human activities that impact the river.

3. The Federal agencies will develop performance measures for the actions taken in the estuary.

Army Corps of Engineers (COE)

Tributary

1. The Corps will use available funding and authorities to implement restoration actions in priority subbasins and in areas such as the Walla Walla basin, where water-diversion-related issues could cause take of listed species.

This requirement is not in the Basinwide Strategy but is found in RPA Action 149, 2000 FCRPS BiOp.

Mainstem

1. Study the feasibility (including both biological benefits and ecological risks) of habitat modification to improve spawning conditions for chum salmon in the Ives Island area.

The objectives of the study will be to determine whether it would be beneficial to increase the frequency of access to spawning habitat or the areal extent of spawning habitat by means other than flow augmentation. The feasibility study will evaluate actions to alter the hydraulic control points that limit flow in the Ives Island area to provide the same areal extent and quality of sustainable spawning habitat (including characteristics such as upwelling through the gravels currently present at the site) at lower levels of Bonneville discharge; reconstruct spawning channels to increase the extent of habitat available at a given level of Bonneville discharge; and maintain hydraulic connections between tributary habitats and the mainstem Columbia River to allow entry for adults and emergence channels for juveniles.

Corresponding 2000 FCRPS RPA Action- 156

Estuary

1. BPA and the COE will seek funding and develop an action plan to rapidly inventory estuarine habitat, model physical and biological features of the historical lower river and estuary, identify limiting biological and physical factors in the estuary, identify impacts of the FCRPS system on habitat and listed salmon in the estuary relative to other factors, and develop criteria for estuarine habitat restoration.

Corresponding 2000 FCRPS RPA Action- 158

2. The COE (federal lead) and BPA, working with Lower Columbia River Estuary Program (LCREP) and NMFS, shall develop a plan addressing the habitat needs of salmon and steelhead in the estuary.

Specific plans will be developed for salmon and steelhead habitat protection and enhancement. These plans should contain clear goals for listed salmon conservation in the estuary, identify habitats with the characteristics and diversity to support salmon productivity, identify potential performance measures, identify flow requirements to support estuarine habitat requirements for salmon, and develop a program of research, monitoring, and evaluation. The plans should be completed by 2003.

Corresponding 2000 FCRPS RPA Action- 159

3. The COE and BPA, working with LCREP, shall develop and implement an estuary restoration program with a goal of protecting and enhancing 10,000 acres of tidal wetlands and other key habitats over 10 years, beginning in 2001, to rebuild productivity for listed populations in the lower 46 river miles of the Columbia River.

Much of the complexity of the estuary's historic shallow-water habitat and much of the estuary's saltwater wetlands have been lost due to the effects of local, navigational, and hydropower development. LCREP proposes a 10-year program to protect and enhance high-quality habitat on both sides of the river to support salmon rebuilding. A high priority should be put on tidal wetlands and other key habitats to rebuild productivity in the lower 46 river miles. Federal agencies will provide technical and financial support for this program and for efforts to implement on-the-ground activities identified in planning.

As more information is gained from inventory and analytical work, the 10,000-acre goal may be modified to ensure that habitats that are determined to be important to the survival and recovery of anadromous fish are addressed. Examples of acceptable estuary habitat improvement work include the following:

- Acquiring rights to diked lands
- Breaching levees
- Improving wetlands and aquatic plant communities
- Enhancing moist soil and wooded wetland via better management of river flows
- Reestablishing flow patterns that have been altered by causeways
- Supplementing the nutrient base by importing nutrient-rich sediments and large woody debris into the estuary
- Modifying abundance and distribution of predators by altering their habitat
- Creating wetland habitats in sand flats between the north and south channels
- Creating shallow channels in inter-tidal areas
- Enhancing connections between lakes, sloughs, side channels, and the main channel

Corresponding 2000 FCRPS RPA Action- 160

4. The COE, with the U.S. Fish and Wildlife Service will significantly reduce Caspian tern and cormorant predation on salmonids. In the short term, it will preclude Caspian tern nesting on Rice Island. For the long term, it will disperse the tern population to its range of historic nesting in Pacific states.

5. Support a Lower Columbia River Estuary Program (LCREP) designated entity to build a major information management and public education initiative through the LCREP to focus on endangered species, habitat loss and restoration, biological diversity and human activities that impact the river.

6. The Federal agencies will develop performance measures for the actions taken in the estuary.

D. Interim Abundance and Productivity Targets for Pacific Salmon and Steelhead Listed under the Endangered Species Act in the Interior Columbia Basin

These interim abundance and productivity targets are provided for geographic spawning aggregations of naturally produced spawning adults. They address the portion of each evolutionarily significant unit's (ESU's) historical range below the major mainstem dams that do not provide for fish passage (e.g., Chief Joseph Dam on the upper Columbia, Hells Canyon Dam on the Snake mainstem and Dworshak Dam on the north fork Clearwater River). The potential role of geographic spawning aggregations above these dams in the ESU's viability as a whole will be evaluated through the formal recovery planning process guided by recommendations from the Interior Columbia Technical Recovery Team (Interior TRT).

It is important to note that these interim targets are not in the context of the whole ESUs, rather they are defined for tentative geographic spawning aggregations within the ESUs. The Interior TRT will develop more accurate population definitions to replace these preliminarily defined spawning aggregations. The TRT will also generate alternative delisting scenarios – different combinations of viable salmonid populations that would each provide for the recovery of the ESU as a whole.

Existing Delisting Objectives – Snake River spring/summer chinook, Snake River sockeye, Upper Columbia spring chinook and Upper Columbia steelhead

Recommended recovery objectives have been developed for Snake River spring/summer chinook spawning aggregations, Snake River fall chinook and Snake River sockeye by the Snake River Recovery Team (Bevan et al., 1994). Those recommendations were modified to apply to index stock areas[1] based on recommendations from the IDFG v NMFS Biological Requirements Workgroup (BRWG, 1994) and were incorporated into the 1995 Proposed Snake River Recovery Plan (NMFS, 1995). The targets were further modified based on input from the Idaho Department of Fish and Game and were included in another draft recovery plan for Snake River Salmon (NMFS, 1997). Population definitions and recommended abundance and productivity objectives have also been developed for upper Columbia spring chinook and steelhead ESU spawning aggregations in the Methow, Entiat, and Wenatchee through the QAR (Quantitiative Analytical Report) process (Ford et al., 2001). Ford et al. (2001) did not identify an abundance goal for the Okanogan due to a lack of sufficient historical information. However, the potential for naturally spawning aggregations in this area will be evaluated by the Interior TRT. Tables 1(a) and 1(b) summarize those specific recommendations for interim targets for listed chinook and sockeye stocks in the upper Columbia and Snake River basins. Productivity criteria for Snake River sockeye were developed in the 2000 FCRPS BiOp (NMFS, 2000) for a 40-48 year

[1]The index area recovery objectives were developed for use in assessing the status of Snake River spring chinook stocks. Index areas have established time-series of scientific observations (e.g., redd counts), and are generally smaller in scale than geographic spawning aggregations. Objectives for these specific index areas have played a key role in the recent series of Federal Hydropower system Biological Opinions (e.g., NMFS, 2000; see section 1.3.1). Index area recovery objectives are included in Table 1(a).

time period, recognizing the time required to institute habitat rehabilitation options and the time lag of response in the sockeye populations. However, to be consistent with the targets provided for the other ESUs, the productivity targets given for Snake River sockeye in Table 1(b) represent only a general biological rule of thumb over a time period of 8 years.

New Delisting Objectives – Interior Columbia Steelhead and Middle Columbia Steelhead ESU
Population definitions, abundance and productivity targets for Snake River and Middle Columbia steelhead have not been formally developed. For these ESUs, geographic spawning aggregations and interim abundance targets are based upon the QAR approach used in the Upper Columbia Biological Requirements Report (Ford et al., 2001), and from: descriptions in the 1990 Subbasin Plans; recommendations from state level stock surveys (e.g., ODFW, 1995; WDFW, 1993; IDFG, 1985); NMFS' Proposed Recovery Plan for Snake River Salmon (NMFS, 1995); the 2000 Biological Opinion on the operation of the Federal Columbia River Power System (FCRPS BiOp) (NMFS, 2000); and Oregon Department of Fish and Wildlife reports regarding conservation assessments (Chilcote, 2001; ODFW, 1995). Table 2 lists possible interim abundance targets and interim productivity objectives for major steelhead spawning aggregations in the Upper Columbia, the Middle Columbia and the Snake River ESUs. The abundance values listed for the Wenatchee, Entiat and Methow subbasins are the levels recommended through the QAR process (Ford et al., 2001). Productivity criteria for Snake River and mid-Columbia steelhead were developed in the 2000 FCRPS BiOp (NMFS, 2000) for a 40-48 year time period, recognizing the time required to institute habitat rehabilitation options and the time lag of response in the steelhead populations. However, to be consistent with the targets provided for the other ESUs, the productivity targets given for Snake River and mid-Columbia steelhead in Table 2 represent only a general biological rule of thumb over a time period of 8 years.

Interim Targets – Description and Discussion of Caveats
<u>Interim Abundance Targets</u>
The enclosed Tables provide interim abundance targets generally representing the geometric mean of spawner escapement over time scales of eight years or approximately two generations. A challenge for co-managers, in the context of these interim abundance targets, is how to measure their progress toward recovery. Uncertainties associated with estimates of abundance and population trends must be considered when determining whether a population's recovery abundance goal has been met. These issues will need to be addressed in formal recovery planning.

<u>Interim Productivity Objective</u>s
In the long-term, a viable population will be characterized by a natural replacement rate (population growth rate) that fluctuates due to natural variability around an average of 1.0, but at an abundance high enough to provide a low risk of extinction. In many cases, spawner abundances are currently far below the levels required to minimize longer term risks of extinction. In those cases, average growth rates for spawner aggregations must exceed a 1:1 replacement rate until viable population abundance levels are achieved. These interim productivity and abundance targets should not be considered in isolation. A replacement rate $\geq$1 is indicative of a healthy population only if the abundance target has been achieved as well. However, a measure of the growth rate during the rebuilding/recovery phase may be most

informative to subbasin planning groups in the near term, as population growth parameters are more reliably quantified than are abundance parameters. The enclosed Tables include recommendations of productivity objectives utilizing the above rules of thumb, as well as recommendations from the FCRPS BiOp (NMFS, 2000), the QAR (Ford et al., 2001), and the Proposed Snake River Recovery Plan (NMFS, 1995).

*Interim Spatial Structure and Diversity Objective*s

The provided interim abundance and productivity targets are just a start, and do not provide a comprehensive index of healthy populations. Typically, a recovered ESU would have healthy populations representative of all the major life history types, and of all the major ecological and geographic areas within an ESU. In the absence of specific diversity data about populations, conservation of habitat diversity might be used as a reasonable interim proxy. More specifically, the QAR Biological Requirements Report (Ford et al., 2001) developed the following objective for upper Columbia River populations: "In order to be considered completely recovered, spring chinook (and steelhead) populations should be able to utilize properly functioning habitat in multiple spawning streams within each major tributary, with patterns of straying among these areas free from human caused disruptions." Furthermore, the FCRPS BiOp (NMFS 2000) states that "... currently defined populations should be maintained to ensure adequate genetic and life history diversity as well as the spatial distribution of populations within each ESU." NMFS recommends that these approaches be utilized in early Interior Columbia subbasin planning efforts.

Table 1(a). Interim Objectives – Listed Snake River and Upper Columbia Chinook ESUs[2]

Geographic Spawning Aggregations		Interim Abundance Targets [3]		Interim Productivity Objectives
***ESU*/Spawning Aggregation**	**Index Areas**	**Spawning Aggregation**	**Index Areas**	
Upper Col. Spring Chinook ESU				Upper Col. Spring chinook populations are currently well below recovery levels. The geometric mean[4] Natural Replacement Rate (NRR) will therefore need to be greater than 1.0 (QAR recommendations; Ford et al., 2001)
Methow	Methow	2000	2000	
Entiat	Entiat	500	500	
Okanogan		– – [5]		
Wenatchee	Wenatchee	3750	3750	
Snake River Spring/Summer Chinook ESU				"For delisting to be considered, the eight year (approximately two generation) geometric mean cohort replacement rate of a listed species must exceed 1.0 during the eight years immediately prior to delisting. For spring/summer chinook salmon, this goal must be met for 80% of the index areas available for natural cohort replacement rate estimation." (Proposed Snake River Recovery Plan; NMFS, 1995)
Tucannon River		1000		
Grande Ronde River		2000		
	Minam		439	
Imnaha		2500		
	Mainstem		802	
Lower Mainstem tributaries		1000		
Little Salmon River Basin		1800		
Mainstem Salmon small trib's		700		
South Fork Salmon (Sum.)		9200		
	Johnson Cr.		288	

[2]These interim targets are derived from: Bevan et al., 1994; BRWG, 1995; NMFS, 1995; and NMFS, 1997.

[3]Eight year, or approx. 2 generations, geometric mean of annual natural spawners. Abundance targets are also provided for smaller scale "Index Areas".

[4]Using the geometric mean as opposed to the arithmetic mean is a common practice when dealing with data series with inherently high annual variability. In the Columbia basin, the geometric mean has been used as a standard measure in the series of Biological Opinions issued covering the Federal Columbia River Power system (e.g., NMFS, 2000, section 1.3) and in the upper Columbia QAR.

[5]Ford et al. (2001) did not identify an abundance goal for the Okanogan due to a lack of sufficient historical information. However, the potential for naturally spawning aggregations in this area will be evaluated by the Interior TRT.

Table 1(a) *continued*. Interim Objectives – Listed Snake River and Upper Columbia Chinook ESUs

Geographic Spawning Aggregations		Interim Abundance Targets		Interim Productivity Objectives
***ESU*/Spawning Aggregation**	**Index Areas**	**Spawning Aggregation**	**Index Areas**	
Snake River Spring/Summer Chinook ESU (cont.)				*(see above)*
Middle Fork Salmon River		9300		
	Bear Valley/Elk		911	
	Marsh Cr.		426	
Mainstem Tributaries (Middle Fk. to Lemhi)		700		
Lemhi River		2200		
Pahsimeroi (Sum.)		1300		
Mainstem Tributaries (Sum.) Lemhi to Redfish Lake Cr.		2000		
Mainstem Tributaries (Spr.) Lemhi to Yankee Fork		2400		
Upper East Fork Trib's (Spr.)		700		
Upper Salmon Basin (Spr.)		5100		

Table 1(b). Interim Objectives – Snake River Fall Chinook and Sockeye ESUs

ESU	**Interim Abundance Targets**[6,7]	**Interim Productivity Objectives**
Snake River Fall Chinook ESU	2500	"For delisting to be considered, the eight year (approximately two generation) geometric mean cohort replacement rate of a listed species must exceed 1.0 during the eight years immediately prior to delisting. For spring/summer chinook salmon, this goal must be met for 80% of the index areas available for natural cohort replacement rate estimation." (Proposed Snake River Recovery Plan; NMFS, 1995)
Snake River Sockeye ESU	1000 spawners in one lake; 500 spawners per year in a second lake.	The Snake River sockeye ESU is currently well below recovery levels. The geometric mean Natural Replacement Rate (NRR) will therefore need to be greater than 1.0.[8]

[6]These interim targets are derived from the Snake River Recovery Team recommendations included in the 1995 Proposed Snake River Recovery Plan (NMFS, 1995).

[7]Eight year, or approx. 2 generations, geometric mean of annual natural spawners in the mainstem Snake River

[8]The 2000 FCRPS BiOp provided a productivity objective for Snake River sockeye, Snake River and Middle Columbia steelhead populations of "a median annual population growth rate (lambda) greater than 1.0 over a 40-48 year period." (NMFS, 2000).

Table 2(a). Interim Objectives – Snake River Steelhead ESU[9]

***ESU*/Spawning Aggregations**	**Interim Abundance Targets**[10]	**Interim Productivity Objectives**
Snake River Steelhead ESU		Snake River ESU steelhead populations are currently well below recovery levels. The geometric mean Natural Replacement Rate (NRR) will therefore need to be greater than 1.0. [8]
Tucannon R.	1300	
Asotin Cr.	400	
Grande Ronde		
Lower Gr. Ronde	2600	
Joseph Cr.	1400	
Middle Fork	2000	
Upper Mainstem	4000	
Imnaha	2700	
Clearwater River		
Mainstem	4900	
South Fork	3400	
Middle Fork	1700	
Selway R.	4900	
Lochsa R.	2800	
Salmon River		
Lower Salmon	1700	
Little Salmon	1400	
South Fork	4000	
Middle Fork	7400	
Upper Salmon	4700	
Lemhi	1600	
Pahsimeroi	800	

[9]These interim targets are derived from: Ford et al., 2001; Chilcote, 2001; NMFS, 1995; ODFW, 1995; WDFW, 1993; and IDFG, 1985.

[10]Eight year, or approx. 2 generations, geometric mean of annual natural spawners.

Table 2(b). Interim Objectives – Upper & Middle Columbia River Steelhead ESUs[11]

ESU/ Spawning Aggregations	Interim Abundance Targets[12]	Interim Productivity Objectives
Upper Columbia Steelhead ESU		
Methow R.	2500	Geometric mean Natural Return Rate (NRR) should be 1.0 or greater over a sufficient number of years to achieve a desired level of statistical power. (QAR recommendations; Ford et al., 2001)
Entiat R.	500	
Okanogan R.	– – [13]	
Wenatchee R	2500	
Middle Columbia Steelhead ESU		
Yakima River		Middle Columbia ESU steelhead populations are currently well below recovery levels. The geometric mean Natural Replacement Rate (NRR) will therefore need to be greater than 1.0. [8]
Satus/Toppenish	2400	
Naches	3400	
Mainstem (Wapato to Roza)	1800	
Mainstem (above Roza)	2900 [14]	
Klickitat	3600	
Walla-Walla	2600	
Umatilla	2300	
Deschutes (Below Pelton Dam complex)	6300	
John Day		
North Fork	2700	
Middle Fork	1300	
South Fork	600	
Lower John Day	3200	
Upper John Day	2000	

[11]These interim targets are derived from: Ford et al., 2001; and NMFS, 2000.

[12]Eight year, or approx. 2 generations, geometric mean of annual natural spawners

[13]Ford et al. (2001) did not identify an abundance goal for the Okanogan due to a lack of sufficient historical information. However, the potential for naturally spawning aggregations in this area will be evaluated by the Interior TRT.

[14]NWPPC smolt capacity reduced by 50% to reflect shared production potential with resident form.

Literature Cited and References Used

Bevan, D., J. Harville, P. Bergman, T. Bjornn, J. Crutchfield, P. Klingeman, and J. Litchfield. 1994. Snake River Recovery Team: Final Recommendations to the National Marine Fisheries Service, May 1994.

BRWG. 1994. Progress report of the Biological Requirements Workgroup. Analytical methods for determining requirements of listed Snake River salmon relative to survival and recovery. October 13, 1994.

Chilcote, M.W. 2001 (Feb. Draft). Conservation assessment of steelhead populations in Oregon. Oregon Department of Fish and Wildlife Report, 86 pp.

Ford, M., P. Budy, C. Busack, D. Chapman, T. Cooney, T. Fisher, J. Geiselman, T. Hillman, J. Lukas, C. Peven, C. Toole, E. Weber, and P. Wilson. 2001. Upper Columbia River steelhead and spring chinook salmon population structure and biological requirements. NMFS, NWFSC. Upper Columbia River Steelhead and Spring Chinook Biological Requirements Committee Final Report

Howell, P.A., K. Jones, D. Scarnecchia, L. LaVoy, W. Kendra, D. Ortmann, C. Neff, C. Petrosky, and R. Thruow. 1985. Stock Assessment of Columbia River anadromous salmonids. Vol. III: Steelhead Trout. Bonneville Power Administration Report.

IDFG. 1997. Anadromous Fish Management Plan, 1997. Idaho Department of Fish and Game.

IDFG. 1992. Anadromous Fish Management Plan, 1992-1996. Idaho Department of Fish and Game.

IDFG. 1985. Anadromous Fish Management Plan, 1985. Idaho Department of Fish and Game.

Leider, S.A., P.L. Hulett, and T.H. Johnson. 1994. Preliminary Assessment of Genetic Conservation Management Aggregations for Washington Steelhead. Implications for WDFW's Draft Steelhead Management Plan and the Federal ESA. Washington Department of Fish and Wildlife Report #94-15, 42 pp.

Kostow, K. (ed.). 1995. Biennial Report on the status of wild fish in Oregon. Oregon Department of Fish and Wildlife Report, 217 pp. + appendix tables.

Marshall, D., H. Mundie, P. Slaney, and G. Tayloe. 1980. Preliminary Review of the predictability of smolt yield for wild stocks of chinook salmon, steelhead trout, and coho salmon. Stream Enhancement Research Committee. SEP Workshop Report. Vancouver, B.C.

NMFS. 1995. Proposed Recovery Plan for the Snake River. National Marine Fisheries Service, March, 1995.

NMFS. 1997. Snake River Salmon Recovery Plan - *Predecisional Document*. National Marine Fisheries Service.

NMFS. 2000. Federal Columbia River Power System Endangered Species Act Section 7 Biological

Opinion, 2000. National Marine Fisheries Service.

ODFW. 1995. Comprehensive Plan For Production and Management of Oregon's Anadromous Salmon and Trout - Steelhead Plan Part III. Oregon Department of Fish and Wildlife, 1995.

Petrosky, C.E. and T.B. Holubetz. 1988. Idaho habitat evaluation for offsite mitigation record. Annual Report, 1987. Project 83-7. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife.

Rich, B. A. and C.E. Petrosky. 1992. Idaho Habitat and Natural Production Monitoring. Annual Report to the Bonneville Power Administration, 107 pp.

WDFW. 1993. Washinton State Salmon and Steelhead Stock Inventory (SASSI). Washington Deptartment of Fish and Wildlife. Appendix 3: Columbia River Stocks, 580 pp.

APPENDIX C

MATRIX OF PATHWAYS AND INDICATORS
FOR EVALUATING THE EFFECTS OF HUMAN ACTIVITIES ON
ANADROMOUS SALMONID HABITAT IN HERD CREEK SUB-WATERSHED

Matrix of Pathways and Indicators for Evaluating the Effects of Human Activities on Anadromous Salmonid Habitat in Herd Creek Sub-Watershed

Pathways / Indicators	Environmental Baseline Condition[1]			Effects Of The Action(s)[2]			
	Properly Functioning	Functioning at Risk	Not Properly Functioning	Restore	Maintain	Degrade	Compliance with ACS
Watershed Conditions							
Watershed Road Density	X				X		X
Streamside Road Density	X				X		X
Landslide-Prone Road Density	X				X		X
Riparian Vegetation Condition	X(UW)	X(LW)			X(-)		X
Peak/Base Flow			X		X(+)		X
Water Yield (ECA)	X(UW)	X(LW)			X		X
Sediment Yield			X			X(-/+)	X
Channel Conditions and Dynamics							
Width/Depth Ratio			X		X(+)		X
Streambank Stability			X		X		X
Floodplain Connectivity			X		X		X
Water Quality							
Temperature			X		X		X
Suspended Sediment			X			X(-/+)	X
Chemical Contamination/Nutrients	X				X		X
Habitat Access							
Physical Barriers		X		X(-)			X
Habitat Elements							
Cobble Embeddedness			X	X(-)		X(-/+)	X
Percent Surface Fines			X	X(-)		X(-/+)	X
Large Woody Debris			X(LW)		X		X
Pool Frequency			X(LW)		X(+)		X
Pool Quality	X(LW)		X(LW)		X(-/+)		X
Off-channel Habitat	X(LW)		X(LW)		X		X
Habitat Refugia		X(LW)			X(+)		X
Bull Trout Subpopulation Characteristics & Habitat Integration							
Subpopulation Size	X			X			X
Growth and Survival	X			X			X
Life History Diversity and Isolation	X			X			X
Persistence and Genetic Integrity	X			X			X
Integration of Species and Habitat Condition	X			X			X

Restore means to change the function of an indicator for the better, or that the rate of restoration is increased.

Maintain means that the function of an indicator will not be degraded and that the natural rate of restoration for this indicator will not be retarded.

Degrade means to change the function of an indicator for the worse, or that the natural rate of restoration for this indicator is retarded. In some cases, a “not properly functioning” indicator maybe further worsened, and this should be noted.

-/+ = will not substantially change the baseline condition but will move in a negative or positive direction in the short or long-term

UW = Upper Watershed

LW = Lower Watershed

Dichotomous Key Determinations

1. Does the authorizing agency have discretionary authority to grant, modify, or amend provisions of the use authorization(s)? **Yes**/No

A "**No"**, results in a "**NO EFFECT**" determination and the evaluation is completed. If "**Yes**", move to question #2.

2. Are there naturally reproducing species listed or proposed for listing present at any time of the year in riverine habitat directly or indirectly affected by the actions? **Yes**/No

If "**Yes**", continue with question #3 through #11. If "**No**", document the "**NO EFFECT"** determination and the evaluation is completed.

3. Can the action change the existing input of Large Woody Debris (LWD) into occupied habitat? Yes/**No**/NA
4. Can the action affect stream morphology for occupied habitat? **Yes/**No/NA
5. Can the action affect properly functioning condition of the riparian area for occupied habitat? **Yes**/No/NA
6. Can the action affect water quality and/or quantity in occupied habitat? **Yes**/No/NA
7. Can the action affect the water flow regime/annual hydrography in occupied habitat? Yes/**No**/NA
8. Can the action affect juvenile or adult behavior related to survival or reproduction? **Yes**/No/NA
9. Will the action involve toxic and/or hazardous materials which may reach occupied habitat? **Yes**/No**/**NA
10. Can the action affect juvenile or adult access to habitat? Yes/**No**/NA
11. Can the action affect substrate material? **Yes**/No/NA

"**No**" responses to question #3-11 would result in a **"NO AFFECT"** finding and should be documented in the action file.

A "**Yes**" to any of the questions #3-11, results in a "**MAY AFFECT**" determination; continue with questions #12-14.

12. Are the effects described in #3-11 inconsequential/temporary in nature? **Yes**/No
13. Do the actions employ Best Management Practices (BMPs) designated to meet State water quality standards? **Yes**/No/NA
14. Is mitigation established that would preclude or reduce measurable effects on species and their habitat? Yes/**No**/NA[1]

"**Yes**" responses to #12-14 results in a "**<u>NOT LIKELY TO ADVERSELY AFFECT</u>**" determination.

"**No**" responses to #12-14 results in a "**LIKELY TO ADVERSELY AFFECT**" determination. **If the project can't be mitigated to a "NOT LIKELY TO ADVERSELY AFFECT", go to Documentation of Expected Incidental Take.**

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[1] The proposed actions are determined **"Likely to Adversely Affect"** Snake River spring/summer chinook salmon because of the potential for short-term degradation of downstream habitat as a result of turbidity, suspended sediment, and sedimentation, and the potential avoidance of the project area during instream work that may affect migratory or staging fish during the implementation year, or cause harassment of adults, juveniles, and fry.